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*Dept of Civil Engineering*

Physical Sci  
Applied Sci  
Mechanical  
Electrical  
Engineering

ENGINE STORAGE

# Nova Scotia Technical College

## Calendar



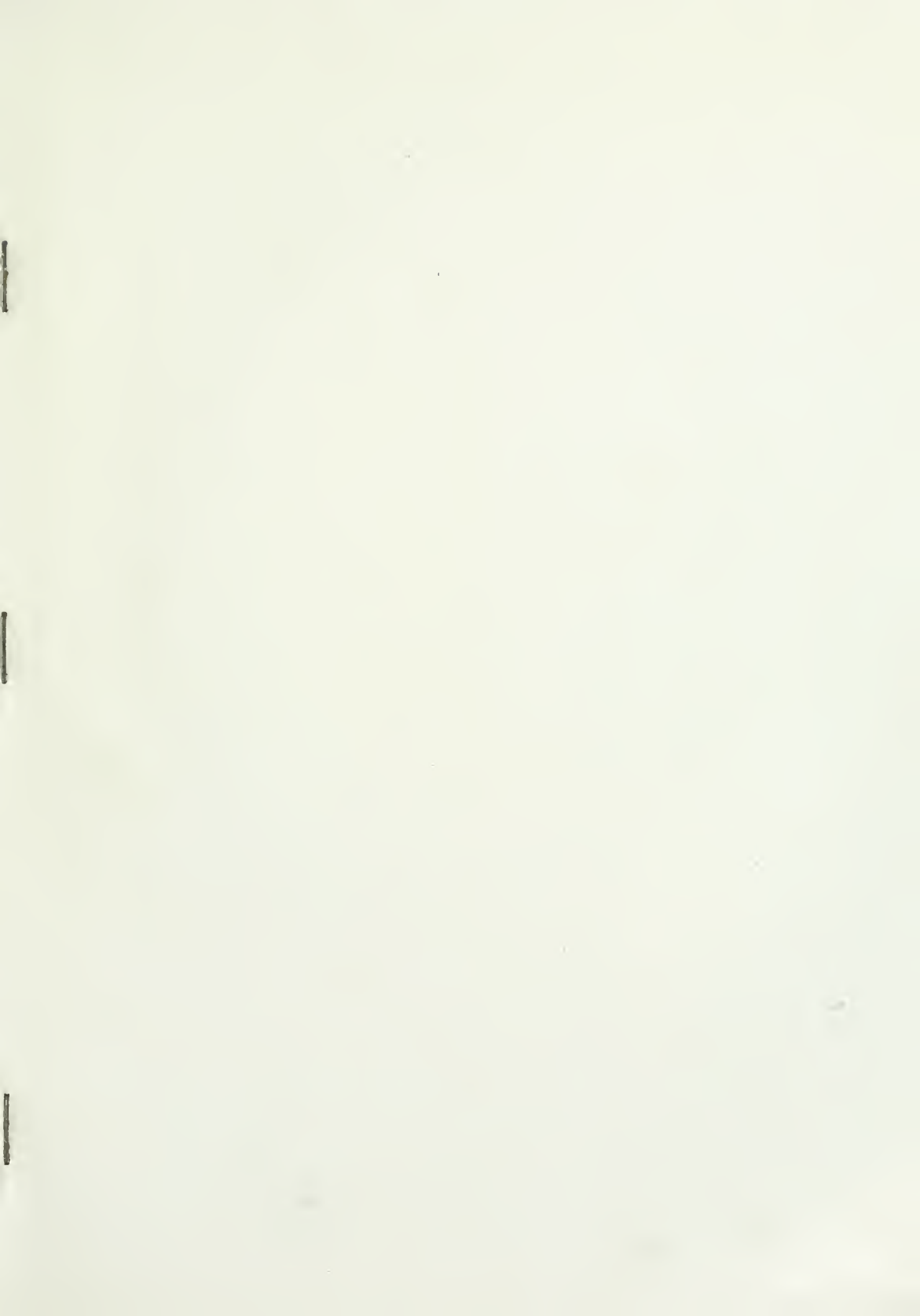
Halifax, N. S.

1914

1915









NOVA SCOTIA TECHNICAL COLLEGE - MECHANICAL DEPARTMENT

# CALENDAR.

1914.

August 29, Saturday, Registration for Civil Engineering Summer Camp.

August 31—Sept. 19, Civil Engineering Summer Camp.

September 21, Monday, Registration for College Classes.

September 22, Tuesday, Lectures begin.

October—Saturday to Tuesday, Thanksgiving vacation.

December 24, Saturday, Christmas vacation begins.

1915.

January 4, Monday, class work resumed.

January 6, Wednesday, Short Course for Land Surveyors begins.

January 18, Monday, Mid-year examinations begin.

January 27, Wednesday, Second Semester begins.

March 6, Saturday, Short Course for Land Surveyors closes.

May 12, Wednesday, Final Examinations begin.

May 21, Friday, Commencement Day.

May 24, Monday, Summer vacation begins, Summer Mining School begins.

June 26, Saturday, Summer Mining School ends.

**Note.**—Students intending to attend Civil Engineering Summer Camp must notify the Secretary of the College on or before Aug. 15th., 1914.

**PROVINCE OF NOVA SCOTIA.****Council of Public Instruction.**

Hon. G. H. Murray, M. P. P., Premier and Provincial Secretary.

Hon. O. T. Daniels, M. P. P., Attorney-General.

Hon. E. H. Armstrong, M. P. P., Commissioner of Public Works and Mines.

Hon James McDonald, M. P. P.

Hon. Jason M. Mack, M. L. C.

Hon. G. E. Faulkner, M. P. P.

Hon. R. M. McGregor, M. P. P.

Hon. J. W. Comeau, M. P. P.

A. H. McKay, LL. D., Superintendent of Education, Secretary.

**NOVA SCOTIA TECHNICAL COLLEGE.****Board of Governors.**

Prof. F. R. Haley, M. A., Acadia University.

Prof. J. N. Finlayson, Dalhousie University.

Prof. J. B. McCarthy, University of Kings College.

Prof. J. W. Crowell, University of Mount Allison College.

Rev. H. P. McPherson, D. D., University of St. Francis Xavier College.

Prin. F. H. Sexton, Nova Scotia Technical College.

Prof. J. W. Roland, Nova Scotia Technical College.

Prof. W. S. Ayars, Nova Scotia Technical College.

Prof. S. N. Graham, Nova Scotia Technical College.

**NOVA SCOTIA TECHNICAL COLLEGE.****Instructing Staff.**

F. H. Sexton, S. B., Principal.

W. S. Ayars, M. E., Prof. of Electrical and Mechanical Engineering.

J. W. Roland, A. B., S. B., Professor of Civil Engineering.

S. N. Graham, S. B., Professor of Mining Engineering and Metallurgy.

G. F. Murphy, B. E., Instructor in Mining Engineering and Metallurgy.

C. A. Hodge, S. B., Instructor in Electrical and Mechanical Engineering.

G. R. Haight, S. B., Instructor in Civil Engineering.

Judge W. B. Wallace, Lecturer in Law of Contracts.

F. M. Dawson, S. B., Lecturer in Hydraulics.

A. F. Barnes, Lecturer in Electrical Engineering.

Capt. E. O. Alabaster, Lecturer in Military Science.

H. Piers, Librarian and Curator of the Museum.

L. B. Taylor, Secretary.

M. G. Doyle, Engineer.

E. H. Nauss, Stenographer.

## GENERAL STATEMENT.

### Foundation and Purpose.

The Nova Scotia Technical College was established by the passing of an "Act Relating to Technical Education" on the 25th day of April, 1907, by the Lieut-Governor, Legislative Council, and House of Assembly of Nova Scotia.

The aims and scope of this institution are outlined in the Public Statutes of Nova Scotia, 1907, Chapter 1, Sections 5—11.

"5. There shall be established at Halifax an institution for the purpose of affording facilities for scientific research and instruction and professional training in civil, mining, mechanical, chemical, metallurgical, and electrical engineering or any other departments which may from time to time be added.

"6. The institution shall be called the Nova Scotia Technical College.

"The Governor-in-Council is hereby authorized to borrow a sum not exceeding \$100,000 and to expend the same in securing a site, erecting a building, and providing adequate apparatus, plant, books, materials and appliances for the purposes of said institution.

"8. The Council of Public Instruction may from time to time make such rules and regulations as it deems expedient for the efficient conduct of the said institution, and may amend or repeal the same.

"9. The Director of Technical Education, shall be the Principal of the said institution.

"10. The Council of Public Instruction shall, upon the recommendation of the principal, appoint such professors and instructors as the Council considers requisite for the purposes for which the institution is established.

"11. (1) The members of the teaching staff of the institution, having the rank of professors, and such representatives of any university of the province or elsewhere, as the Council may select, shall constitute a body corporate, under the name of the Nova Scotia Technical College.

(2) The said corporation shall have power to grant such degrees as it may determine, to prescribe the several qualifications therefor, the course of study to be pursued in the several departments, and, in respect to all matters of discipline and all matters connected with the educational work of the institution, shall have the conduct and control thereof.

"(3) In the event of any part or parts of the course of study prescribed for the first and second years being included in the educational work done in the universities recognized by the Council in this province or elsewhere, the Council of Public Instruction shall exclude such parts from the course of study of the said institution."

During the session of the Provincial Legislature in 1908-9, an additional \$100,000 was voted for the construction and equipment of engineering laboratories.

During the session of 1909-10, the Legislature appropriated a further sum of \$50,000 for a mining and metallurgical laboratory.

During the session of 1911-12, the Legislature appropriated an additional sum of \$39,000 for buildings, equipment, and apparatus.

### **Main Building.**

The main building of the Technical College, which contains the lecture rooms, science laboratories, museum, library, gymnasium, and assembly hall, has been completed three years. It is an imposing building of pressed red brick and freestone, erected on the military property adjoining the Court House on Spring Garden Road in Halifax. The main structure is 146 feet long, 48 feet wide, and has two wings, 41 by 52 feet each.

In the basement, room is provided for a workshop, fan room, store room, assaying laboratory, balance room, metallography laboratory, locker room, cement laboratory, and gymnasium.

The first floor contains the administration offices, museum, curator's office, geological laboratory, lecture rooms, electrical measurements laboratory, electrical research laboratory, dark room, and heat laboratory.

On the second floor are the staff offices, library, chemical laboratory, chemical research laboratory, lecture rooms, drafting room, and assembly hall. The building has a steel frame, reinforced concrete floors, and is of slow-burning construction throughout.

### **Engineering Laboratories.**

The main building for the engineering laboratories was erected in 1909. This building, 40 by 160 ft., contains the central power plant, mechanical engineering laboratory, machine shop, materials testing laboratory, and hydraulic laboratory.

During the year 1911-12 the Murray Laboratory of Mining and Metallurgy was completed and the equipment partly installed. The details of the building and equipment are given in the following paragraphs:

Space has been provided for a sample grinding room, supply room, workshop, lecture room, drafting room, testing laboratory, office; and lavatory. The main portion of the building consists of one large space which is devoted to metallurgical and ore dressing processes.

The equipment for sample grinding consists of 1 Braun Chipmunk Crusher, 1 Braun Disc Pulverizer, 1 Braun Rotary Hand Grinder, 1 Allis-Chalmers Type B Sample Grinder, 1 Gates Sample Crusher, Type F. This sample grinding apparatus is driven by an independent 5 H. P., three phase, Westinghouse motor.

The equipment for metallurgy will consist of a blast furnace for smelting lead and copper ores, a hand reverberatory roasting furnace, an English cupelling furnace, a copper refining furnace, experimental cyanide plant, a pot roaster, a Bessemer convertor for copper mattes, a small coking oven, etc.

The ore dressing equipment consists of a coal washing plant as manufactured by the Jeffrey Mfg. Co., for the United States Government Coal Testing Laboratory, 1-7'' x 10'' Blake Rock Breaker, 1 Type O D Gates Gyratory Breaker, 1-5' Huntington Mill, 1 set 10'' x 12'' laboratory crushing rolls, 1-6'' vertical mill elevator 1 set standard trommels, 1-2 compartment laboratory Harz jig, 1-Richards Pulsator jig, hydraulic cone classifiers, 1 half-size Wilfley concentrating table, 1-Standard 4' Frue suspended vanner, 1 James Slime Table, 1-five stamp mill with 450 lb. stamps and Hendy Challenge Feeder, 1 Frenier Sand Pump, 1 magnetic separator, 1 Abbe' Ball Mill.

There is installed in the building a model mine plant with a 30 H. P. upright tubular boiler, 1-10''x10''

x10'' Ingersoll straight line compressor, 1-5''x6'' Lidgerwood friction hoist with 10'' drum. It is planned to make every student in mining engineering thoroughly familiar with these fundamental machines before graduation.

Apparatus for the testing of materials for highway construction is also installed in the Mining and Metallurgical Laboratory. This consists of 1 De Val abrasion cylinder, 1 ball mill, 1 Olsen standard impact testing machine, 1 Olsen Page cementation briquette former, and 1 Olsen Diamond saw.

In this Mining and Metallurgical Laboratory industrial research on the mineral resources of the provinces is carried on as well as the instruction of college students in Mining Engineering.

### **College Government.**

The Governing functions of the Nova Scotia Technical College are vested in a Board of Governors and the Council of Public Instruction. The Board of Governors consists of one member nominated by each of the five affiliated colleges and universities in the Maritime Provinces, together with the professors of the teaching staff of the Technical College.

This Board makes all regulations in regard to admission requirements, general curriculum, and other matters which concern the general standard and welfare of the College. The Board of Governors is under the supervision and control of the Council of Public Instruction, and all regulations made by the former body must receive the ratification of the latter.





MURRAY LABORATORY OF MINING AND METALLURGY.

### Affiliation.

The Nova Scotia Technical College is affiliated with the following universities,—Acadia, Dalhousie, King's, Mount Allison, and St. Francis Xavier. By the terms of the affiliation, the separate universities offer a uniform course in engineering covering the first two years, and the Technical College offers professional courses in several departments of engineering covering the last two years course. Students from the separate universities are admitted to the Technical College on certificate without examination under certain conditions enumerated later. The matriculation requirements for entrance into the uniform engineering course of the separate colleges are also uniform and are set forth in the succeeding paragraph.

### Admission to the First Two Years Engineering Course in the Affiliated Universities.

Applicants for admission must have attained the age of 16 years.

Acadia, Dalhousie, King's and St. Francis Xavier have accepted amended requirements for admission which were put into force in September 1911. The following is an outline of the subjects and the standard or grade in each subject which is required for admission as a regular engineering student:

#### 1. *Arithmetic and Algebra:*

Arithmetic.

Algebra, as in Grade XII, or equivalent.

2. *Geometry and Trigonometry:*

Geometry as in Grade XII, or equivalent.  
Trigonometry: Plane Trigonometry, as in  
Grade XII, or equivalent

3. *English:*

As in Grade XII, or equivalent.

4. *French or German:*

As in Grade XI, or equivalent.

5. *History:*

As in Grade XI, or English and Canadian  
History.

## 6. One of the following.:

- (a) *Latin*, as in Grade XI, or equivalent.
- (b) *Greek*, as in Grade XI, or equivalent.
- (c) Additional work, equivalent to that required for Grade XII, in the language chosen in Subject 4.

### **Regulation for Students Conditioned in Matriculation.**

"No student shall be admitted to the full work of the first year of the engineering course who is deficient in mathematics, or more than one other matriculation subject. Any student who has more conditions than outlined above, may enter College and take a combined Arts and Engineering Course, provided that he can satisfy the matriculation requirements of that college. Such a person cannot be considered a regular first year student in engineering, and will require three years of work to complete the first two years of the engineering course. All matriculation requirements must be removed before the student can enter the second year of the engineering course."

In plain language this means that a sharp distinction shall be drawn between the regular student who has passed all matriculation requirements, and a student who has not obtained the required standard. Any student who fails in matriculation examinations in Mathematics, or in more than one subject, will have to take another year in the Academy and pass the Grade XII. examinations, or else he may enter College as a conditioned student, and take up in the first year Arts Course the subjects in which he was conditioned.

It is better for the average student to spread the first two years engineering course over a period of three years, so that he may be better grounded before entering the Technical College and it is earnestly recommended that students should pursue this course.

Mount Allison has not yet accepted these new regulations for matriculation, so that the same requirements as were in force in 1910-11 obtain at Mount Allison University in New Brunswick. They are as follows:

1. *Arithmetic and Algebra:*

Arithmetic.

Algebra as in Hall and Knight's Elementary Algebra, excepting Chap. 41.

2. *Geometry and Trigonometry:*

Geometry: Euclid, Books I to VI inclusive.

Trigonometry: As in Murray's Plane Trigonometry, Chap I. to VIII, or equivalent; or Practical Mathematics, as in Grade XI.

3. *English:*

As in Grade XI. or equivalent.

4. *French or German:*

As in Grade XI or equivalent.

5. *History:*

As in Grade XI or English and Canadian History.

## 6. One of the following:

(a) *Latin*, as in Grade XI or equivalent.

(b) *Greek*, as in Grade XI or equivalent.

(c) Additional work equivalent to that required for Grade XII in the language chosen as *Subject 4*.

(d) *Mechanical Drawing*: Projection of points, lines, plane figures, and simple solids, dimensioned sketches and working drawings of simple machine parts, lettering and dimensioning of drawings neatly and accurately done.

**Note**—In all cases where mechanical drawing is offered, as in No. 6 (d), all the plates must be submitted, together with certificates stating where the drawing was done.

### Admission to the Technical College.

Applicants must have attained the age of eighteen years.

The students who enter the Technical College will be classified as *regular* or *special*. Regular students are

those who are full candidates for degrees, and special students are those who voluntarily, or by reason of not having passed all requirements up to the time of classification, are taking special courses.

Admission to the Technical College will be on certificate from the properly authorized officer of the university at which the student has pursued his first two years engineering course. The certificates must state the subjects taken, the marks made in each subject, and the pass mark required at that university in engineering courses. Certificate blanks will be furnished on application to the Principal of the Technical College.

*Regular* students will be admitted to the Technical College who have secured the required proficiency in *all the courses* of the first two years Engineering Course as hereafter outlined.

Special students will not be permitted to take more than three courses simultaneously if they wish their work to count toward a degree.

**Note**—The following temporary exception has been adopted:

Regular students will be permitted to enter the Technical College who are *conditioned in one subject only* of the first two years course, provided that that subject is not one of the following:

*Mathematics, Physics, Chemistry, Surveying or Drawing.*

The right, however, is reserved to exclude as a regular student anyone who has failed in any other subject of the preliminary course than those specified above.

### **Admission to Advanced Standing in the Technical College.**

Any person may be admitted to advanced standing in the Technical College by passing such examinations as are deemed necessary by the College faculty, or by submitting such certificates of previous records of study or experience as shall satisfy the faculty. All applications for special examinations for advanced standing must be made to the principal of the college before September 1st, 1914.

Any person on the payment of the required fee and the production of evidence to the faculty of sufficient knowledge and training to benefit by the instruction in any separate class or classes given in the Technical College, may enter and pursue such class or classes as a special student.

### **Degrees.**

To whomsoever shall satisfactorily acquire the requisite proficiency in all the regular courses of either Civil, Mining, Mechanical, or Electrical Engineering as prescribed in this calendar shall be given by the Technical College a degree of Bachelor of Science in that department in which he has pursued his studies.

### **Certificates.**

Anyone attending one or more classes in the technical College and attaining the requisite standard of proficiency in said class or classes shall, on application, receive a certificate attesting to the exact work done.

### **Tuition Fees, Deposits, Etc.**

The tuition for instruction in any regular department of engineering shall be seventy-five dollars (\$75)

per year, forty dollars of which shall be paid within one month from the opening in September and the remainder during the first month of the second term, which begins usually in February.

To those who are attending special classes the fees are as follows:—

|                                                                                          |         |
|------------------------------------------------------------------------------------------|---------|
| For any single class for one-half year . . . . .                                         | \$ 7.50 |
| “ any single class for one whole year, or for two<br>classes for one-half year . . . . . | 12.00   |
| “ three classes for one-half year . . . . .                                              | 18.00   |
| “ four “ “ . . . . .                                                                     | 23.00   |
| “ five “ “ . . . . .                                                                     | 28.00   |
| “ six “ “ . . . . .                                                                      | 33.00   |
| “ seven “ “ . . . . .                                                                    | 38.00   |
| “ eight or more classes for one-half year . . . . .                                      | 40.00   |
| “ seven or more classes for whole year . . . . .                                         | 75.00   |
| Short course for Land Surveyors . . . . .                                                | 15.00   |

An advance deposit of \$5.00 will be required of all students taking laboratory classes on entrance to the same to cover breakage or damage to apparatus. An itemized account of supplies or damages will be rendered at the end of year for settlement.

### Scholarships.

There is one free scholarship of a value of seventy-five dollars (\$75.00) for each of the eighteen counties of Nova Scotia, except the counties of Halifax and Cape Breton, for which there are two free scholarships each. These scholarships are to be awarded on the basis of need and merit after the results of the mid-year examinations. The applicants for scholarships must have been *bona fide* residents for more than three years in the county for the scholarships for which they

are seeking. If there is no applicant in any one year for a certain scholarship, a student, resident in any other county for more than three years previously may by permission of the Faculty apply for the vacant scholarship and may be awarded the same by the Faculty.

### **First Two Years Uniform Engineering Course in the Affiliated Universities.**

Acadia, Dalhousie, King's, and St. Francis Xavier have amended the two years' uniform engineering course in their respective universities. Following is the outline of the amended courses as they will be carried out after September, 1911, in the above colleges:

#### **I. Mathematics—**

1. Solid Geometry . . . . . 24 hours.
2. Analytical Geometry . . . . . 48 hours.
3. Calculus: Differential and Integral 96 hours.

#### **II. Chemistry—**

1. Gen. Chemistry: Lectures . . . . . 72 hours.
2. Gen. Chemistry: Laboratory . . . . . 96 hours.
3. Qualitative Analysis: Lectures . . . 24 hours.
4. Qualitative Analysis: Laboratory 96 hours.

#### **III. English—**

1. English Composition . . . . . 48 hours.

#### **IV. Drawing—**

- Freehand: Mechanical and Machine Drawing . . . . . 240 hours.

**V. Physics—**(Including Mechanics, Electricity, Heat, Light, and Sound.)

1. Lectures and Recitations.....120 hours.
2. Laboratory .....120 hours.

**VI. Surveying—**

1. Lectures ..... 48 hours.
2. Field work, Mapping, and Topographical drawing.....144 hours.

**VII. Descriptive Geometry—**

Lectures, Recitations, and Drawing.. 72 hours.

**VIII. General Geology—**

Lectures..... 48 hours.  
Laboratory and Field Work..... 72 hours.

**IX. Kinematics—**

Kinematics of Machines..... 72 hours.

**X. Workshop .....216 hours.**

**Prerequisites.**

Students who are entering the Technical College and are deficient in any of the required entrance subjects will not be allowed to take any course for which that subject is a prerequisite.

Any student who wishes to take a special course in the Technical College must have previously passed

the course which will enable him to benefit by the advanced instruction. The prerequisites for the regular courses are given in the following table:—

|                                             |                                     |
|---------------------------------------------|-------------------------------------|
| Mechanics of Engineering . . .              | Mathematics and Physics.            |
| Railway Location . . . . .                  | Trigonometry and Surveying.         |
| Thermodynamics . . . . .                    | Mathematics and Physics.            |
| Advanced Surveying . . . . .                | Trigonometry and Surveying.         |
| Roads and Pavements . . . . .               | Surveying and Trigonometry.         |
| Machine Design . . . . .                    | Drawing and Kinematics of Machines. |
| Electrical Machinery . . . . .              | Physics.                            |
| Electrical Laboratory . . . . .             | Physics.                            |
| Applied Geology . . . . .                   | Geology.                            |
| Quantitative Analysis . . . . .             | Chemistry.                          |
| Principles of Metallurgy . . . . .          | Chemistry.                          |
| Mine Surveying . . . . .                    | Surveying.                          |
| Mechanical Engineering Laboratory . . . . . | Kinematics of Machines.             |
| Assaying . . . . .                          | Chemistry.                          |
| Mineralogy . . . . .                        | Chemistry and Geology.              |

If a student, however, wishes to study some special course and does not wish to count this towards a degree, he may be allowed to take such course at the discretion of the Faculty of the Technical College upon his presenting a signed statement that he does not wish the work to count towards a degree.

### **Details of Courses in First Two Years Engineering Course.**

Some attempt has been made to unify some of the special courses so that instructors in the different colleges may have some plan that they could follow.

So far the instructors in Physics have agreed upon a course in Laboratory Physics which would cover the work outlined in the requirements with an alternative of 10 experiments in Electricity and Magnetism in the place of experiments 45, 46, 47, 48 and 49 on Light.

### Experiments in Physics Laboratory.

- 1 Vernier caliper. Measurement of length and volume.
- 2 Micrometer caliper.
- 3 Spherometer. Radius of curvature.
- 4 Reading by vibrations. Sensitiveness of a balance.
- 5 Method of double weighing. Weight in vacuo.
- 6 Verification of the law of moments.
- 7 Verification of the laws of equilibrium of three forces acting at a point.
- 8 Verification of the laws of equilibrium of an extended rigid body under the action of three forces.
- 9 Centre of gravity of a weighted bar.
- 10 Mechanical advantage and "efficiency" of a combination of pulleys.
- 11 Coefficient of friction.
- 12 Determination of "g" by means of a simple pendulum.
- 13 Verification of Hooke's Law. Young's Modulus by stretching a wire.
- 14 Moment of Inertia. Moment of Torsion.
- 15 Use of the barometer. Corrections to be applied to the reading.
- 16 Density of solids and liquids by means of a chemical balance.
- 17 Density by means of Nicholson's Hydrometer.
- 18 Density by Jolly's Balance.
- 19 Proof of Boyle's Law for air.
- 20 Velocity of waves in a stretched string.
- 21 Determination of pitch by the sonometer.
- 22 The resonance-tube. Velocity of sound in air.
- 23 Velocity of sound in brass. Kundt's method.
- 24 Testing the fixed points of a mercury thermometer.
- 25 Coefficient of linear expansion of a solid
- 26 Coefficient of cubical expansion of a liquid. The weight thermometer.
- 27 Specific heat. Method of mixtures.
- 28 Latent heat of fusion of water.
- 29 Rate of radiation. The plotting of "cooling curves."
- 30 Mapping the magnetic field around a bar magnet. Moment by neutral point.
- 31 Moment of a magnet by oscillation method.
- 32 Moment of a magnet by deflection method.
- 33 Magnetic inclination or dip.
- 34 Determination of "H" by the magnetometer.
- 35 Tangent galvanometer. Sine and tangent methods of measuring currents.
- 36 Electro-chemical equivalent of copper.

- 37 Determination of "G" or "H" by the deposition of copper.
- 38 Proof of Ohm's Law.
- 39 Measurement of resistances, B. A. Bridge.
- 40 Specific resistance.
- 41 Temperature coefficient of resistance.
- 42 Wheatstone Bridge. (1) Resistance of a galvanometer. (2) Resistance of batteries.
- 43 Comparison of electromotive forces.
- 44 Verification of Joule's law.
- 45 Comparison of intensities of illumination by means of a photometer.
- 46 Verification of the laws of reflection from (1) a plane mirror., (2) a spherical mirror.
- 47 Index of refraction of glass plate with plane parallel faces.
- 48 Focal length of a convex lens.
- 49 Construction and magnifying power of (1) a telescope, (2) a microscope.

#### Alternative.

- 1 Comparison of resistances, Carey Foster Method (Tory and Pitcher, p. 209.)
- 2 Measurement of small resistances (T. & P. p. 221.)
- 3 Measurements of large resistances (T. & P., p. 225.)
- 4 Determination of resistance of a D'Arsonal Galvanometer by shunting. (T. & P., p. 243.)
- 5 Determination of constant of a D'Arsonal galvanometer. (T. & P., p. 247.)
- 6 The absolute capacity of a condenser, Ballistic galvanometer, (T & P., p. 270.)
- 7 Comparison of condensers (T. & P., p. 278.)
- 8 Determination of the magnetic elements by the earth inductor.
- 9 Comparison of two coefficients of self-induction.
- 10 The magnetic permeability of iron.

Details of the other courses are being considered by the various colleges at present and it is hoped that greater uniformity can be secured in all courses in the near future.

#### Engineering Camp.

A united engineering camp for students between the second and third and the third and fourth years, will be held in some place to be selected in Nova Scotia, August 31st, to September 19th, 1914. There will be required a deposit of eighteen dollars (\$18) for this class.





### Short Courses.

The Technical College is offering two special short courses this year, viz.: (1) Short Course in Land Surveying. (2) Short Course in Highway Construction.

A detailed description of these courses will be found on pages 85 & 87.

The course in land surveying is intended to qualify men to hold positions as land surveyors under the new regulations passed by the Legislature in 1909-10. Any one who successfully passes the course and who has had practical experience as set forth in the said Act is given a certificate as a duly qualified provincial land surveyor.

The course in highway construction is designed for those who are engaged in the construction of rural highways. This is a practical course. It is the aim to leave theory in the background as much as possible, and to consider for the most part the practical side of road building, which concerns every farmer, town officer, and especially every road superintendent and inspector.

### EQUIPMENT.

A great deal of time and thought has been spent on the equipment for the various laboratories to select a good, thorough, up-to-date assembly of apparatus for teaching purposes. The apparatus as far as it has been purchased already, is given below.

### Civil Engineering.

*Surveying Instruments.*—1 Queen transit, 2 Gurley transits, 1 Buff and Buff transit, 1 Keuffel and Esser mining transit, 1 Buff and Buff triangulation theodolite,

1 Buff and Buff Wye level, 2 Gurley levels, 1 Buff and Buff Dumpy level, 1 Stanley level, 1 Keuffel and Esser level.

*Testing Machines.*—One hundred thousand pound capacity testing machine, extensometer for tension and compression, improved deflection instrument, improved dial deformeter, Gilmour needle, Briquette moulds, Le Chatelier specific gravity apparatus, Olsen's compression micrometer, encased abrasion cylinder, 2,000 lb. traction dynamometer, 50,000 lbs. hydraulic compression testing machine, traverse tester of 10,000 lb. capacity, 60,000 inch-pound torsion testing machine.

### **Electrical Engineering.**

A great deal of the apparatus of the Electrical Department is used jointly with the Mechanical Engineering Department. The larger units are in the Engineering Laboratories building and the others in the main building in the Dynamo Laboratory, in the Electrical Measurements Laboratory, in the Dark Room, and in the Battery Room.

The main power-unit is a 50 K. W. 3-wire D. C. generator, 220-110 volts, direct connected to a Robb automatic cut-off 10"x12" high-speed engine. This set is wired up so as to supply direct current to the laboratories, and for light and power in all the buildings. In addition, there are connections to the Halifax Electric Tramway Companies lines through two transformers; one supplying 220-volt 3-phase 60-cycle current for power, and the other 3-wire, 220-volt 60-cycle current for lighting the buildings. In the Dynamo Laboratory is a motor-generator set consisting of a Can. Westinghouse Co. 3-phase induction motor directly connected to a D. C. Generator 110 volts, 42 amperes

of same make, supplying 110 volts. This set is connected to the permanent wiring of the building for supplying D. C. when the need is not sufficient to demand running the main unit. Its energy is drawn from the Halifax Tram Company's mains, 220 volts, 3-phase.

In the Engineering Laboratory are also located the hand and power tools comprising the machine-shop equipment. Power for the shop is supplied by a motor belted to a line shaft. The college shops are not intended as part of the teaching equipment directly, but are used principally for the repair and manufacture of apparatus and equipment. In addition to the machine shop drive, other electrical machines in the Engineering Laboratory are two 5. H. P. motors direct connected to turbine and centrifugal pumps, and another of the same size belted to a small air-compressor. There is also a Canadian General Electric Co. Edison bipolar generator 125 V., 25 K. W. which can be belted to any one of several engines and used as a load or tested as a generator or motor. Other motors in this building are used to drive various testing machines; all are for 220 volts D. C., taking power from the outside wires of the main generating set. This building also contains the main switchboard with a complete equipment of indicating and recording instruments, leakage indicator, circuitbreakers, and switches.

In the Dynamo Laboratory are a Fairbanks motor-generator set, compound wound, consisting of two similar 220-volt D. C. 5 H. P. dynamos either of which can be run as a motor driving the other as a generator; the Westinghouse A. C. - D. C. motor-generator set before mentioned; one special laboratory rotary convertor

with six slip-rings, capable of a great variety of experimental work; two Canadian General Electric 5. H. P. 3-phase A. C. dynamos with extra rotors, also capable of operation in various ways as motors or generators; 2 shunt and 2 series C. G. E. motors, 5 H. P. 110 volts, which can be run on brake-load, belted to other machines, or direct connected, as desired. There are also a Can. Westinghouse 5 H. P. single-phase A. C. motor, a C.G. E. single phase repulsion motor of about the same power; a Lincoln variable-speed D. C. motor with a wide range; and a number of small motors and generators, A. C. and D. C. single-phase and three-phase.

Nearly all the above machines are mounted on heavy tables with steel frame-work supports, bringing them to a convenient height for observation, examination or adjustment; and while most of them are large enough so that the parts are on a good, sturdy, visible scale, it is nevertheless not difficult to move them about from place to place, and to make new connections, mechanical or electrical, for various experiments. The motors can be loaded by brake, by direct connection, or by belting; and the generators by lamp-bank, direct or belt connection, or water rheostat. There are three lamp banks; one of 250-volt 16 c.p. carbon incandescent lamps; one of 125 volt 32 c.p. lamps, and one of 125-volt 16 c.p. lamps. Each contains about 190 lamps with switches for throwing in any desired number or combination.

The Dynamo Laboratory also contains the cases where the usual measuring instruments are kept. This equipment is exceptionally complete, comprising a wide range of voltmeters, ammeters, and watt meters, principally of the Weston make, for direct and alternating current, including a number of shunts, multipliers, series and potential transformers, etc. There are

four Starrett and two Schaeffer and Budenburg speed indicators; several mechanical tachometers, one Weston electric tachometer and one Hopkins electric speedometer. There is also an ample assortment of slide-wire manganin rheostats, and standard field resistance rheostats; and each motor of any size is provided with suitable starting resistance or compensator. This laboratory also contains a special laboratory switch board in two panels. It is provided with 3 Weston D. C. switchboard Ammeters and 2 Weston voltmeters, with 3 integrating wattmeters. The front terminals are in the form of sockets, and flexible cables with end plugs are used, thus making almost any combination of connections possible. There is also a number of circuit-breakers, switches and fuses, and the charging and discharging connections and switches for the storage battery. Adjoining the switch board is a ten ampere C. G. E. mercury arc rectifier; and in this room are kept a number of standard and special transformers, in size from 7.5 K. W. down, some being provided with a great number of taps, and mounted in portable stands with terminal boards for plug connection.

In the Electrical Measurements Laboratory are kept the more delicate laboratory standard and precision instruments. These include a number of fine instruments of Siemens-Halske make, a Weston laboratory-standard millivoltmeter with shunts and multipliers, bridges of various makes, Leeds and Northup potentiometer, electric pyrometers, galvanometers, standard resistances and all other essential instruments for close and accurate work. In this room are located a powerful spark coil with electrolytic interrupter and controlling resistance by Siemens-Halske, and used for X-ray and similar experiments, and a large number of parts of standard electrical machines for illustrative purposes; also a fine G. E. oscillograph for both visual and photographic work.

In the basement is the battery-room, with a 60-cell Westinghouse storage battery, end cell regulation, and a number of other batteries, primary and secondary; and between the Dynamo and Electrical Measurements Laboratories is the dark room with a 72" cylindrical electrical blue-print machine made by Keuffel & Esser, with Adams-Bagnall 15 amp. enclosed A. C. arc lamp and regulating compensator, and a large Elliot photometer. The laboratories also contain samples of all the more common electrical appliances in general use, such as wiring fixtures, sockets, conduits, switches, different sorts of insulated wire and cable, various types of arc and incandescent lamps, telephones, telegraph instruments, dry and wet batteries, scales and balances, micrometers, machinists' and electricians' tools, fuses, and spare and repair parts for many of the machines and appliances. None of the apparatus is cheap or unreliable, and students are free to use any of the equipment under proper direction and care when they are sufficiently advanced to understand how to handle it intelligently. No voltage higher than 220 is obtainable without special connections, so there is practically no danger to any student working in the laboratories, unless he deliberately tries to hurt himself.

### **Mechanical Engineering.**

The main units in the mechanical laboratory are located in the Engineering Laboratories building. Power is derived from two horizontal return tubular boilers of 80 H. P. each, which in addition supply heat to all the buildings. These are hand-fired, natural draft, and may be fed by either injectors or feed pump. They are supplied with the usual accessories for testing. The return from the heating system are fed back automatically into the boilers by the Bundy double-acting trap systems; there is also a Cochrane openheater

used with the feed pump for feeding hot water when any of the steam-units are running. These latter are as follows:—

One horizontal cross-compound non-releasing Robb Corliss automatic cut-off engine with cylinders 12" x by 20" stroke, having especially wide range of adjustment of governor and valve gear, and built by the International Engineering Works of Amherst, N. S. (Formerly Robb Engineering Co.) This engine is designed for a normal load of 150 H. P. non-condensing to about 220 H. P. condensing, at 180 R. P. M. There are two pulleys for taking off power by belt, and the L. P. side has the shaft extended through an out-board bearing carrying a flange-coupling for direct-connection to dynamometer or other load.. In addition the main pulley, which serves also as a flywheel is equipped with a water-cooled brake as made by the Westinghouse Machine Co., of ample capacity to absorb the full power of the engine. There is a direct 8" exhaust to the atmosphere, and a 9" exhaust to surface condenser, also a 4" connection to the heater.

One automatic high-speed engine, Robb make, 75 H. P. 10" x 12" direct connected to 3-wire generator as given under Electrical Engineering. This engine can exhaust to condenser, to atmosphere or to heater, and, like the large engine, is fully equipped for testing.

One 10 H. P. horizontal engine by James Leffel Co., balanced slide valve, medium speed, equipped for valve setting, testing, etc.

One vertical 8. H. P. engine by I. Matheson & Co., equipped for testing.

One Kerr Steam turbine, 20 B. H. P. at 3600 R. P. M.

One de Laval turbine, 20,000 R. P. M., gear connected to Sturtevant high-speed blower.

One Worthington surface-condenser, three-pass, 350 sq. ft. of cooling surface, mounted on stanchions

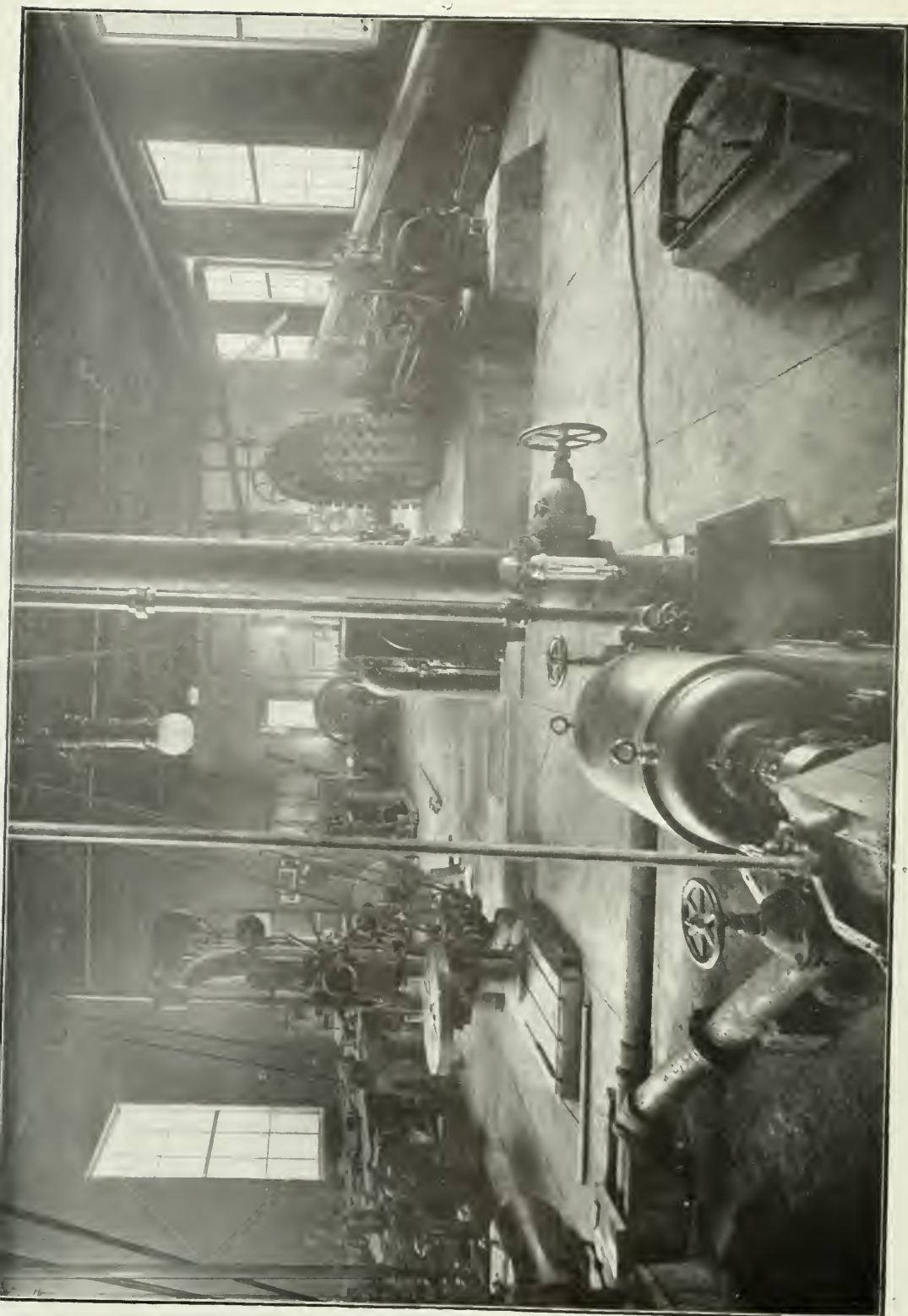
over independent steam-driven vacuum pump. In addition, there is a Sims heater, 87 sq. ft. of tubes so mounted that it may be used as a surface condenser at atmospheric pressure. This heater can be used as a condenser for any of the smaller units when the evaporation under atmospheric exhaust conditions is to be measured.

In addition to the boiler feed pump and the vacuum pump belonging to the surface condenser, there are—one McDougall duplex steam pump 10" x 6" x 10", one Blake duplex pump, two centrifugal and one turbine pump, motor-driven. By means of open and pressure tanks at different levels, these pumps may be driven under varying conditions of lift and pressure.

Other sources of motive power are: one Crossley Oil Engine of 4 H. P., hot tube ignition, which may be run with various fuels; one Fairbanks-Morse 4 H. P. horizontal gas or gasoline engine; one "Gray Motor", vertical 2 cycle engine, 12 H. P. at 600 R. P. M. (This engine can be run on gasoline or kerosene by proper changes in the carburetor); one 4-cylinder Ford automobile motor, and the other parts of the Ford chassis and transmission gear.

For heat measurements there are: one Boys' standard gas calorimeter with pressure regulator and meter; Parr calorimeters for calorific value of coal; total carbon apparatus for proximate coal analysis; Ellison's throttling-evaporating calorimeter for obtaining dryness of steam; Carpenter's separating calorimeter; barrel calorimeter; calorimeter for tests on saturated steam; apparatus for determining heat radiation from lagged and bare pipes; small air-compressor with orifice box for determination of flow of air; Hay's flue-gas analysis apparatus complete with gas sampler. For general mechanical laboratory tests; one Crosby gauge tester; one Engler viscosimeter; one Venturi meter complete as made by Builders' Iron Foundry of Providence, R. I.; one Pelton wheel; one weir fitted





for experimental work; one hydraulic ram, with various heads; two large pressure tanks used in connection with various tests in hydraulics and calibration of orifices.

In addition, there is a full equipment of such smaller apparatus as steam and gas engine indicators, planimeters, brakes, weighing apparatus, thermometers, speed counters, and other instruments used jointly with the department of Electrical Engineering.

### **Mining Engineering.**

See pp. 3 *et seq.*

## **SYLLABUS OF ENGINEERING COURSES.**

### **Department of Electrical Engineering.**

As announced elsewhere, the first two years of this course are given in the affiliated colleges. The course as herein described covers the third and fourth years. The plan is to give a broad and thorough training in the theory and practise of applied electricity, together with that portion of its closely allied subject, steam and machine design. Greater stress is laid on thorough knowledge of the more elementary subjects than on the advanced theoretical side of the subject, but as much of the latter is included as can be given in the time available.

The laboratories are exceptionally well supplied with engineering instruments suited to the work to be done throughout the course. It is to be noted further that these instruments are all accurate, high-grade, and reliable, the product of the best makers in America and Europe. They are intended for thoughtful and intelligent use and due care must be used at all times in handling them. Students are held strictly accountable

for injury resulting from rough or careless manipulation and are not entrusted with the finer apparatus, until they have shown proper skill and pains in manipulation and adjusting. The laboratories are located in the main building and in the engineering laboratories building, and are fully described, pp 22-26.

Students taking this course should have a sound working knowledge of mathematics, physics, elementary chemistry, and mechanics. The theoretical work runs parallel with the laboratory work, extending thru the third and fourth years. The laboratory work is carried on with the purpose of developing quick and keen observations, the ability to observe and interpret data logically, quick and skilful manipulation of instruments, manual dexterity, and the careful and intelligent handling of expensive and easily-injured machines. Neatly and legibly written reports are required, accompanied by sketches, log-sheets, and performance curves when needed, and the use of good English is insisted upon.

### **201-202. Electrical Machinery.**

*Third Year, First and Second Semester, Three Hours per Week.*

This course extends through the entire third year. The student starting it is supposed to have a good idea of elementary electricity and magnetism, including the units used in measuring current, resistance, and electromotive force. The course at present follows closely the treatment laid down in the text, *Elements of Electricity*, by W. H. Timbie, and is eminently practical. Large numbers of problems are given, and the direct current dynamo, both as generator and motor, is thoroughly analyzed and studied. The subject is attacked from the magnetic standpoint, and

all the more common practical uses of electricity are studied and explained. Induction, conductivity, insulation, measurements of resistance, current, electromotive force and power; study of instruments; capacity of condensers; primary and storage batteries; electric lighting; elementary principles of alternating currents and the more simple A. C. machinery. So far as possible the higher mathematics are avoided in this course. Most of the machines discussed are tested and reported on in the laboratory. Visits of inspection are made to the Halifax Electric Tramway Co's power plant; to ocean going steamships, mercantile and naval; and to other plants in easy reach of the college, where large and less common machines may be examined and reported upon. In addition to the text, frequent lectures are given, with references to standard works in the library, current periodicals, and the bulletins of leading manufacturers, and students are encouraged to do all the collateral reading for which they can find time.

*Text.*

*W. H. Timbie.*—"Elements of Electricity."

### **201A-202A—Electrical Machinery.**

*An abbreviation of 201-202 for students in Civil and Mining Courses. Two hours per week. Third year.*

### **203-204 Alternating Currents and Machinery.**

*Fourth Year, First and Second Semesters, Three Hours per Week.*

This course is intended only for men in the E. E. Course, and continues the work of 210-202. It goes fully into the fundamentals of alternating current,

transmission and use, the sine curve single and poly-phase systems; impedances in series and parallel, vector diagrams, A. C. motors and generators, transformers, measurement of power in various circuits, central station problems, long distance high-tension transmission, and problems involving the numerous phenomena peculiar to A. C. transmission as compared to D. C. generation, transmission, and utilization. It is taught largely by lectures and references to such authorities as W. S. Franklin, Esty, C. A. Smith, Lyon, Steinmetz, and Karapetoff. A large number of numerical problems are required.

*Text.*

*Franklin and Esty*:—Elementary Electrical Engineering-Alternating Currents.

**208—Electrical Engineering Abstracts.**

*Fourth Year, Second Semester, One Hour per Week.*

The students in E. E. and M. E. meet informally once a week to discuss current magazines, new bulletins and catalogues of leading manufacturers, proceedings of the engineering societies, personal experiences along the lines of electrical work, and items of general interest to the electrical engineer. Reports on assigned topics are required, also occasional quizzes.

**209—Electrical Distribution.**

*Fourth Year, Second Semester, Three Hours per Week.*

This course is taken by both M. E. and E. E. students. It deals with the transmission of power by electrical energy; the design and location of central stations with special reference to the wiring, switching facilities,

safety devices, protection against lightning, line construction, conditions calling for judgment in choice of system installed, automatic and manual regulation of voltage, complications due to high voltage, and the study of various existing plants, both steam and hydro-electric. It is taught by a text and by references to standard works, periodicals, and the bulletins of the leading manufacturers of electrical equipment.

*Text.*

*Weingreen*:—"Electric Power-Plant Engineering."

### 211—Electric Railways.

*Fourth Year, Second Semester, Fifteen Weeks, Two Hours per Week.*

Study of conditions affecting choice of apparatus and system, power requirements, cars and car equipment, track construction, bonding, testing overhead and three-rail distribution.

This course is intended to give the student a thorough knowledge of the fundamental principles of electric railway engineering. A study will be made of acceleration, tractive force and power required; electric locomotives and their electrical construction and properties. The subject is taught by lectures and by references to standard works in the department library. Contemporary practice is studied in the engineering periodicals and the transactions of the professional societies. No special text is prescribed at present.

**212—Electric Design.**

*Fourth year, Second Semester; One Three Hours Period per Week.*

A course of laboratory and drafting to accompany 209. This course takes up the general design of electrical machinery and equipment as dealt with in text-book and lectures given throughout the course. Various practical problems are assigned, to be worked up in the form of computations and working drawings, such as would be worked out by a professional engineer in making up a preliminary layout for an estimate. In this work students are encouraged to attack problems along the line of work in which they may be especially interested. Reading in the department library is necessary. If possible, individual work in the laboratories is done, and visits of inspection made to power plants in the vicinity where similar problems may have been encountered and solved.

**250-251—Electrical Engineering Laboratory.**

*Third Year, First and Second Semester, One Three Hour Period per Week.*

A series of experiments to accompany 201-202. Its purpose is to illustrate and prove the fundamental principles, and to give the students practice in operating and testing electrical machinery. The earlier experiments are extremely elementary, dealing with Ohm's law, the primary battery, resistances in series and parallel, and the use of the voltmeter and ammeter. Considerable practice is given in the use of the Wheatstone bridge and in measuring by fall of potential. Then the direct current dynamo is taken up, both as motor and as generator, and a large number of experiments given, using the wide range of machines in

the college laboratories. D. C. and A. C. arc lamps are tested and studied both mechanically and electrically, and all the common forms of incandescent lamps; instruments are calibrated, storage and primary cells investigated; motor-generators studied, and ample experience given in setting up and disconnecting all sorts of apparatus. Log sheets of all work are carefully kept, and complete and exhaustive reports required, which must be clearly written in good English. No especial laboratory course is used, but most of the experiments can be found in the books given below, or on special sheets issued to the class by the department.

*References.*

*W. H. Timbie*.:—"Electrical Measurements in Direct and Alternating Current."

*V. Karapetoff*.:—"Elementary Electrical Testing."

*C. F. Smith*.:—"Testing of Dynamos and Motors."

*Franklin & Esty*.:—"Dynamo Laboratory Manual."

**252-253— Electrical Engineering Laboratory.**

*Fourth Year, First and Second Semesters, One Three Hour Period per Week.*

A continuation of 250-251, dealing with more difficult problems. Alternating current is taken up and numerous experiments are performed illustrating the truth of the theory taken up in the lecture room. A. C. generators; induction motors single and polyphase; synchronous and repulsion motors; the transformer; impedance, inductance and capacity; the mercury arc rectifier; precise electrical measurements; standardization and photometry. Measurement of power in A. C. circuits, and the use of the synchronous convertor; A. C.-D. C. conversion, and D. C.-A. C.; motor generator; etc.

Power is supplied from the college plant, from the 200 ampere-hour storage battery and from the mains of the Halifax Electric Tramway Company's lines. Opportunities for special investigations are afforded to fourth year students.

*References.*

*C. F. Smith*:—"Alternating Currents."

*Karapetoff*:—"Experimental Electrical Engineering."

(See also under 250-251.)

**215—Storage Battery Engineering.**

*Fourth Year, First Semester, Two Hours per Week.*

This course is designed to give a general knowledge of electrochemistry and the principles of storage battery engineering. The dissociation theory, ionization, electrolysis, primary and secondary cells are discussed; the formation of the plates, causes for deterioration, testing, maintenance and regulation of the lead storage battery. Its care and upkeep, and utilization in modern power work.

*Text.*

*Lyndon*:—"Storage Battery Engineering."

**270—Contracts and Specifications.**

*Fourth Year, All Courses, Second Semester, One Hour per Week.*

This course covers the general subject of preparing specifications and the law of contracts. It is taught in lectures by prominent jurists of the province, and

aims to acquaint the student with the fundamentals of the Law of Contracts, especially those portions of the common law that should be familiar to the practicing engineer. References are given to standard authorities by the lecturer.

**301—Steam Engines, Turbines, and Boilers.**

*Third Year, All Courses, First Semester, Four Hours per Week.*

See Dept. of Mechanical Engineering, page 41.

**302—Thermodynamics,**

*Third Year, Second Semester, Four Hours Per Week.*

See Dept. of Mechanical Engineering, Page 42.

**303—Steam Power Plants.**

*Fourth Year, First Semester, Three Hours per Week.*

See Dept. of Mechanical Engineering, page 43.

**350-351 Mechanical Engineering Laboratory.**

*Third Year, First and Second Semesters, Fifteen Weeks;*

*One Lecture and One 3-Hour Laboratory Period per Week.*

See Dept. of Mechanical Engineering, page 45.

**352-353. Mechanical Engineering Laboratory.**

*Fourth Year, First and Second Semesters; one Lecture and one 3-Hour Laboratory Period per Week.*

See Dept. of Mechanical Engineering, page 45.

Note:—This is optional with E. E. men, but not required

**329-330. Machine Design Theory.**

*Third Year, First Semester, Three Hours, and Second Semester, Two hours per Week.*

See Dept. of Mechanical Engineering, p. 47.

**330A—Machine Design Theory.**

*Fourth Year, First Semester, Two Hours per Week.*

See Dept. of Mechanical Engineering, page 48.

**331-332—Machine Design and Drawing.**

*Third Year, First and Second Semesters, Two 3-Hour Periods per Week.*

See Dept. of Mechanical Engineering, page 48.

**333-334—Machine Design and Drawing.**

*Fourth Year, First and Second Semesters, Fifteen Weeks, Two 3-Hour Periods per Week.*

**333A—Machine Design and Drawing,**

*Fourth Year, First Semester, One 3-Hour Period per Week.*

See Dept. of Mechanical Engineering, page 49.

**101—Mechanics of Engineering 1.**

*Third Year, First Semester, Fifteen Weeks, Five Hours  
per Week.*

See Dept. of Civil Engineering, page 52.

**102—Mechanics of Engineering II.**

*Third Year, Second Semester, First Nine Weeks, Five  
Hours per Week.*

See Dept. of Civil Engineering, page 53.

**103—Materials Testing.**

*Third Year, Second Semester, One 3-Hour Laboratory  
Period per Week.*

See Dept. of Civil Engineering, page 53.

**105—Structures I.**

*Third Year, Second Semester, Last Six Weeks. Five  
Hours per Week,*

See Dept. of Civil Engineering, page 53.

**111—Theoretical Hydraulics.**

*Fourth Year, First Semester, Three Hours per Week.*

See Dept. of Civil Engineering, page 54.

**112—Hydraulic Testing.**

*Fourth Year, First Semester, Three Hours per Week.*

See Dept. of Civil Engineering, page 54.

**153—Hydraulic Engineering.**

*Fourth Year, Second Semester, Three Hours per Week.*

See Dept. of Civil Engineering, page 58.

**600—Technical Writing.**

See Dept. of Civil Engineering, page 61.

**DEPARTMENT OF MECHANICAL ENGINEERING.**

This is a four years' course, the third and fourth of which are given in the Technical College, as outlined in the following schedule. It is designed to convey a thorough knowledge of the basic principles of the design construction, manufacture, and operation of machinery as used in manufacturing industries, power plants, and power transmission, as well as a general idea of the problems to be encountered in the executive and business management of the industries common to all modern civilization. Students who take this course should not only have a thorough elementary training in mathematics, physics, and shopwork, but should have in addition a natural aptitude for machinery, engines, power and hand tools; and no dislike to long hours, hard physical and mental work, and the frequent wearing of overalls. Any men who can enter this course after several years actual experience in machine-shop or power-plant will be all the better fitted for it and for such men there are more openings today than the colleges can supply.

All mechanical engineers require a good general knowledge of applied electricity, and all electrical engineers require thorough training in mechanical principles. Therefore the two courses are similar throughout and identical in the third year. In the fourth year the student drops the more advanced electrical work and goes deeper into the study of the design and performance of machinery, steam and gas engines, and turbines. The mechanical laboratories are designed and equipped to give the student the necessary practice in the handling and testing of machinery in general, and of motive power units particularly. The equipment is complete and modern, and well adapted to illustrate the principles of the course as given in the class-room.

It is not intended to make an expert draftsman out of every student taking this course; nevertheless, a great deal of work must be done on the drawing-board, as it is today absolutely essential that all work shall be completely planned before undertaking any construction. Hence the course includes not only sketching and drawing of machines and their details, but a great deal of graphical and diagrammatic work, rational and empirical designs, and considerable applied kinematics. Those men who enter with a defective knowledge of kinematics will be given a thorough review of the subject, as it is most essential to all engineering work involving valve-gears, cams, linkages, governors, etc.

### **301—Steam Engines, Turbines, and Boilers.**

*Third Year, First Semester, Fifteen Weeks, Four Hours per Week.*

It being essential in order to gain a good theoretical knowledge that the machines or objects studied should be first understood practically, this course is taken up

at the beginning of the third year. Very little of the thermodynamics of steam will be given, but the mechanical principles of engines, pumps, and turbines will be thoroly gone into. After a brief consideration of the theory of the ideal heat engine, the simple slide-valve engine will be taken up, mechanics of the engine, inertia resistances, ideal and practical diagrams of steam and turning force, etc. Then valve gears, valve diagrams, shaft governors, link and other reversible gears; Corliss, double-valve, poppet-valve and four-valve gears; simple and geared steam pumps and pumping engines; compounding; action and reaction turbines; and condenser and vacuum pumps.

The various forms of boilers in common use; their setting, mounting, staying, safety devices, furnaces, fuels, operation and care; numerous problems dealing with the strength and elementary design of boilers and engines, both numerical and graphical. The object of this course is fundamentally to give such a knowledge of steam machinery as is possessed by a good operating engineer in a power plant, ashore or afloat. It is required of all students in the college, and will be taught by a text and lectures, supplemented by visits to marine engine and boiler rooms, and to various plants ashore in Halifax and vicinity.

#### *Texts.*

*Selected Papers from the I. C. S. Course in Steam Engineering. "Steam Boilers" E. M. Shealy.*

### **302—Thermodynamics.**

*Third Year, Second Semester, Four Hours a Week.*

In this course, pure thermodynamics is taken up. The general laws of thermodynamics are established for perfect gases, superheated and saturated vapors,

and their application to problems dealing with air and gas compression and expansion, refrigeration, etc. Isothermal and adiabatic expansion curves are especially considered, and the use of temperature-entropy diagrams. The applications of pure theory to ideal and practical heat engines. Numerous problems, numerical and graphical are given.

This course is essential to all E. E. and M. E. students, and may be taken by others who so desire. It presupposes the work in steam engines and boilers, and a firm grasp of the subject of heat as taught in physics. The work in the mechanical laboratory runs parallel with the lectures dealing with steam, air compression, gas engines, injectors, etc.

### **303.—Steam Power Plants.**

*Fourth Year, First Semester, Three Hours per Week.*

A general study of the choice of suitable units and auxiliaries in power station equipment; the economics of efficiency versus cost; fixed and operating charges; local conditions determining types of engines and boilers to be used; the cost of power; preliminary layouts of power plants under assumed conditions; design preparation of bills of material, estimating of cost of erection and installation; the influence of cost of raw material, fuel, water, load factor and labor on the design; preparation of specifications, standard and special; contracts and guarantees of performance of units.

The auxiliaries of the steam power plant are also studied and discussed in this subject, both as given generally in the text, and more specifically as in such catalogues as that of the Crane Company, taking up valves, fittings, piping, safety valves, traps and drainage, open and closed heaters, water purification for feed water, jet, surface and barometric condensers; the usual national, state, and municipal regulations;

economizers, oils and oiling systems, chimneys, automatic stokers, coal and ash handling, the use of oil and gas fuels, and ordinary labor problems. The course is eminently practical; and, without going into the design of the details, aims to familiarize the student with all the equipment of a modern steam power plant, and the design of its efficient and practical *ensemble*. In addition to the text, numerous references are given to standard authors, and to the catalogues of the representative builders in Canada and the United States.

*Texts.*

*Meyer*:—"Steam Power Plants."  
*Crane Co.*:—"Catalogue No. 40."

**305—Steam Turbines.**

*Fourth Year, Second Semester, Two Hours per Week.*

This is a study of the steam turbine from the theoretical and thermodynamic point of view, as a continuation of the practical and mechanical side taken up in 301 and 302—types of turbines and theory of their action; the flow of steam and its behaviour in passing thru nozzles and buckets of different forms; efficiency of turbines and their utility in general; comparison of turbines with the reciprocating engine.

*Text.*

*Stodola*:—"The Steam Turbine."

**306.—Gas Engines.**

*Fourth Year, Second Semester, Three Hours per Week.*

Gas and oil engines:—mechanical construction; theoretical and actual results; performance, economy and reliability; gas producers and oils; design and operation of engines and producers for various fuels; methods of starting and ignition; sources of trouble, methods of testing; efficiency of large and small units; stationary and marine types.

**307—Mechanical Engineering Abstracts..**

*Fourth Year, First Semester, One Hour per Week.*

A course dealing with current engineering topics and problems. Students meet informally and discuss leading articles in technical journals,, manufacturer's bulletins, trade papers, etc. Reports on assigned topics will be required, and occasional quizzes verbal or written will be held.

**350-351.—Mechanical Engineering Laboratory.**

*Third Year, First and Second Semesters, One 3-Hour Period per Week.*

A series of tests on indicators, gauges, steam, gas and gasolene engines; use of dynamometers and measurement of power; pyrometers and heat measurement; steam and gas calorimeters, pumping machinery and hydraulic motors.

*Reference:*

*Carpenter*:—"Mechanical Engineering Laboratory."

**351—Mechanical Engineering Laboratory.**

*Fourth Year, First and Second Semesters, One 3-Huor  
Period per Week.*

A continuation of the above, dealing with the more difficult problems involved in complete plant efficiency test, boiler tests, and general commercial testing. Visits will be made to local plants, and occasional tests made on such outside plants, under direction of the college officials.

*References:—*

*Carpenter:—*“Experimental Engineering.”

*Flather:—*“Dynamometers and the Measurement of power.”

**322—Heating and Ventilating.**

*Fourth Year, First Semester, Three Hours per Week.*

A course of lectures and recitations planned to teach the fundamental principles and their application to practice in the solution of heating and ventilating problems. The course considers quantity of air required; direct and indirect steam, hot water, and hot air systems; size of ducts, radiators, and total heating surface required; design of heating plants and selection of equipment and material required; methods of temperature and humidity control.

*Text.*

*Carpenter:—*“Heating and Ventilating.”

**329-330—"Machine Design Theory."**

*Third Year, First Semester, Three Hours, and Second Semester, Two Hours per Week.*

Concurrent with 331 and 332. The lecture and recitation part of the designing of machinery, The first semester's work covers the empirical and rational proportioning of the simpler parts of familiar machines such as bolts and other screwed fastenings, keys, cot-  
ters, link and belt drives, shaft couplings and clutches, strength of gear, teeth and other machine parts subject to simple stresses. Later, more difficult work is gradually taken up, as the design of parts subject to compound or alternating stresses, shocks and jars; and the modifications of theoretical design called for by shop systems, legal requirements, economy of output, standardization of product, convenience of transportation, etc. Instruction is also given on drafting-room system, care of notes and data, use of standards, tables, and the slide rule; and the preparation and preservation of calculations and preliminary sketches.

A thorough knowledge of kinematics, elementary and applied mechanics, trigonometry, and elementary mathematics is essential to all students taking up work in machine design. It is one of the most important of all subjects to the practicing mechanical engineer and proficiency is strictly insisted upon for all students in the M. E. course.

*Text.*

*Spooner*:—"Machine Design, Construction and Drawing."

*Kent*:—"Mechanical Engineer's Pocketbook."

**330A—Machine Design Theory.**

*Fourth Year, First Semester, Two Hours per Week.*

A continuation of 329-330, taking up more advanced and difficult work, lectures and recitations, using text as above and references to works in the department library.

**331-332.—Machine Design and Drawing.**

*Third Year, First and Second Semesters, Two 3 Hour Periods a Week.*

The drafting room, or "practicum" work, of which the theoretical principles are covered in 330. A part of the time is devoted to making drawings in detail and assembly of actual machines which are first measured and sketched free-hand, then drawn to scale and traced. Later the detail and assembly drawings are made and traced of simple, but complete machines, every part of which has been designed by the student in accordance with the theories and practice of machine design as taken up in 330. As every good machine designer depends as much upon his intuitive sense of proportion as he does upon formulas and computation, the drafting room work is so planned that the student must use his common sense and experience quite as much as his mathematics and mechanics; and all drawings, tracings, and blueprints must conform to accepted standards and proportions.

**333—Machine Design and Drawing.**

*Fourth Year, First Semester, Two 3 Hour Periods per Week.*

Design of cams and gear teeth, details and assembly of more difficult machines; pipes and piping layouts in connection with course 303; special work along lines in which the student is interested, etc.

Course 333A is similar to 333, but is intended more for electrical students and covers only one-half the time. In both 333 and 333A, free reference is made to the books, periodicals, and catalogues in the department library.

**333A—Machine Design and Drawing.**

*Fourth Year, First Semester, One 3 Hour Period per Week.*

See Course 333 above.

**334—Machine Design and Drawing.**

*Fourth Year, Second Semester, Two 3 Hour Periods per Week.*

A continuation of 333, involving more difficult work in design of engines, machine tools and special or individual problems, particularly those involving a good knowledge of applied kinematics, velocity and acceleration, diagrams and graphical analysis of motions, forces, and velocities.

**336—Mechanical Design.**

*Fourth Year, Second Semester, One 3 Hour Period per Week.*

Individual problems assigned in design along lines in which the students hopes or expects to specialize.

**201-202—Electrical Machinery.**

See Dept. of Electrical Engineering, page 30.

**208—Electrical Engineering Abstracts.**

See Dept. of Elec. Eng., page 32.

**209—Electrical Distribution.**

See Dept. of Elec. Eng., page 32.

**250-251—Engineering Laboratory,**

See Dept. of Elec. Eng., p. 34.

**270—Contracts and Specifications.**

See Dept. of Elec. Eng., p. 36.

Note:—While this course deals with this subject specifically, the subjects of contracts and specifications is also alluded to and discussed in other courses, such as Machine Design, Power Plants, etc., and the student is constantly drilled in his written work in clear and specific wording, and in the accurate and plain use of the English language.

The following courses taken by mechanical engineers are to be found under their respective headings in the Department of Civil Engineering.

**101—Mechanics of Engineering I.**

See Dept. of Civil Engineering, p. 52.

**102—Mechanics of Engineering II.**

See Dept. of Civil Engineering, p. 53.

**103—Materials Testing.**

See Dept. of Civil Engineering, p. 53.

**105—Structures I.**

See Dept. of Civil Engineering, p. 53

**111—Theoretical Hydraulics,**

See Dept. of Civil Engineering, p. 54.

**112—Hydraulic Laboratory.**

See Dept. of Civil Engineering, p. 54.

**153—Hydraulic Engineering.**

See Dept. of Civil Engineering, p. 58.

Also, in the Department of Mining Engineering:

**428—Metallurgy of Iron and Steel.**

See Dept. of Mining Engineering, p. 73.

**600—Technical Writing.**

See Dept. Civil Engineering, p. 61.

**DEPARTMENT OF CIVIL ENGINEERING.**

The course in Civil Engineering covers two years of prescribed studies, designed to provide a thorough foundation in the fundamental principles involved in all engineering practice. Students entering this course should be well prepared in physics, mathematics, (including calculus) elementary surveying and in mechanical drawing and descriptive geometry.

Instruction is given by means of lectures and recitations and by practice in the laboratory, the drawing-room, and the field. It is the aim to cover thoroughly the subjects taught, rather than take up in a superficial manner the whole field of civil engineering subjects. Problems are made as practical as possible and the student is encouraged to depend upon himself in their solution rather than to follow rule-of-thumb methods.

**101—Mechanics of Engineering I.**

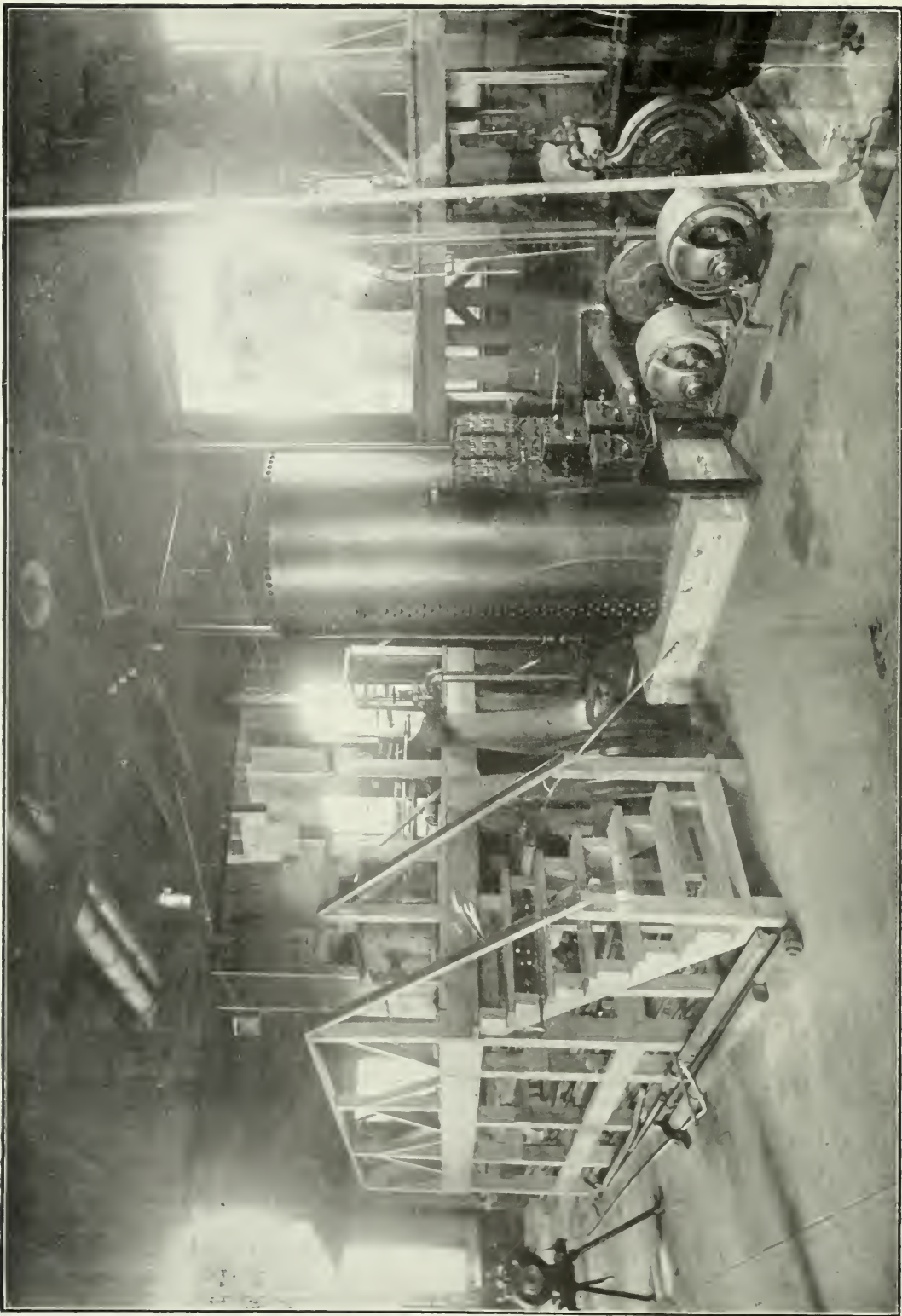
*Third Year, First Semester, Fifteen Weeks, Five Hours per Week.*

This course of study comprises a study of the fundamental principles of statics and dynamics and involves the application of these principles to the solution of numerous problems both in and out of class. Both analytical and graphic methods are employed. Special stress is laid upon those principles most used by engineers.

*Text.*

*Wright:—"Elements of Mechanics."*





**102—Mechanics of Engineering II.**

*Third Year, First Nine Weeks of the Second Semester,  
Five Hours per Week.*

This course comprises a mathematical study of the strength of materials, including stresses and strains in bars subjected to tension, compression, and shearing; the common theory of beams; columns; torsion; resilience.

*Text.*

*Boyd:—"Strength of Materials."*

**103—Materials Testing.**

*Third Year, Second Semester, Fifteen Weeks, One  
3 Hour Laboratory Period per Week.*

This course comprises a series of tests of the strength and elasticity of wood, cast iron, and steel and runs currently with No. 102.

**105—Structures I.**

*Third Year, Last Six Weeks of the Second Semester,  
Five Hours per Week.*

This course is designed as an introduction to the study of structures as taught in the fourth year. It comprises a study of outer and inner forces, reactions, shears, moments, influence lines, concentrated load systems, and the design of beams.

*Text.*

*Spofford:—"Theory of Structures."*

**111—Theoretical Hydraulics.**

*Fourth Year, First Semester, Fifteen Weeks, Three Hours per Week.*

This is a course of 45 exercises in the first semester of the fourth year and deals with the theory of water pressure and the flow of water through orifices, tubes, pipes, canals and rivers, discharge over weirs, and losses due to friction and other causes.

*Text.*

*Russel:—"Hydraulics."*

**112—Hydraulic Laboratory.**

*Fourth Year, First Semester, Fifteen Weeks, Three Hours per Week.*

This course runs concurrently with No. 111 and includes a series of experiments for determining the discharge of orifices, nozzles and weirs under varying conditions, and a determination of the coefficients involved; determination of losses in pipes due to friction and other causes, measurement with the Venturi meter; efficiency tests on the ram, turbine, Pelton wheel, etc.

Students make written reports involving computations, plotted curves, etc., based upon the data collected.

**119—Advanced Surveying.**

*Third Year, First Semester, Fifteen Weeks, Four Hours per Week.*

Lectures, field, and drafting room work covering the following: the use of stadia and plane table in topographic work; precise, barometric and trigonometric

levelling. The mapping of surveys made at the previous summer camp will be completed.

### 120—Advanced Surveying.

*Third Year, Second Semester, Fifteen Weeks, Five Hours per Week.*

The principles of practical astronomy and the determination of latitude, longitude, azimuth, and time with ordinary surveying instruments. Photographic surveying. The relation of geology to topography. Hydrographic surveying and stream gaging.

The drafting room will include a problem in the paper location of a line of railroad.

*Text.*

*Breed and Hosmer*:—"The Principles and Practice of Surveying," Vol. II.

### 121—Railroad Engineering I.

*Third Year, Second Semester, Fifteen Weeks, Four Hours per Week.*

This course comprises a study of the mathematics of curves as used in railroad work, the easement curve, methods of staking out and computing earth work. Numerous problems for outside solution are given, and the practical application of problems studied is constantly emphasized.

*Text.*

*Allen*:—"Railroad Curves and Earthwork."

**122—Railroad Engineering II.**

*Third Year, Second Semester, Fifteen Weeks, Three Hours per Week.*

This is a course devoted to a study of maintenance of way; signalling; train resistances; the influences of grades, distance, curvature, rise and fall; yards and terminals.

*Text.*

*Raymond*—"Railroad Engineering," Vol. II.

**123—Summer School of Surveying.**

Three weeks of field work is carried on in camp in September preceding each of the third and fourth years. The camp is held in a different part of the Province each year.

The object of this course is to give students more extended field practice than is possible during the regular college year. It is the intention that each student shall be given practice with all the instruments used.

The work consists of topographic work with transit, stadia and plane table, and stream measurements with floats and current meters. A complete survey for a short line of railroad is made. Each student is required to keep full sets of notes from which the surveys are plotted and estimates made as the work proceeds.

**124—Railroad Design.**

*Fourth Year, First Semester, Fifteen Weeks, Three Hours per Week.*

A drawing room course of 45 hours in the first semester of the fourth year, involving the application of the principles covered in courses 121 and 122 to problems in trackwork, yards, etc.





**131—Highway Engineering.**

*Third Year, Second Semester, Ten Weeks, Two Hours per Week.*

A course of 20 lectures during the second semester of the third year. It comprises a study of the principles pertaining to the location, construction, and maintenance of roads and the construction and maintenance of the various pavements used for city streets.

*Text.*

*Blanchard and Drowne*:—"Textbook on Highway Engineering."

**141—Masonry Construction.**

*Fourth Year, First Semester, Fifteen Weeks, Two Hours per Week.*

The course is devoted to the study of the materials used in masonry work and to the methods of construction of foundations for bridges, buildings, and other structures.

*Text.*

*Baker*:—"Masonry Construction."

**142—Materials Testing.**

*Fourth Year, First Semester, Fifteen Week, Five Hours per Week.*

This course accompanies 141. The work consists principally of tests of cement and plain and reinforced concrete; tension, compression and transverse tests under varying conditions, materials, and combinations; tests of beams, slabs, columns, and arches.

**151—Water Supply.**

*Fourth Year, Second Semester, Fifteen Weeks, Three Hours per Week.*

The course is devoted to a study of municipal water supply systems, their design and construction; quality of water, examination, tests and methods of purification, sedimentation, filtration, etc; source, quantity, rainfall, evaporation, percolation, storage, reservoirs, ground flow, wells, pumps, and pumping machinery; stand-pipes, water towers, conduits, distribution systems; a study of the quantity required per capita and the variations with diverse conditions; methods and cost of construction, maintenance, and operation.

*Text.*

*Turneure and Russell:—"Public Water Supplies."*

**152—Hydraulic Design.**

*Fourth Year, Second Semester, Fifteen Weeks, Two Hours per Week.*

A drawing room course devoted to the design of structures connected with water supply.

**153—Hydraulic Engineering.**

*Fourth Year, Second Semester, Fifteen Weeks, Three Hours per Week.*

The time is given over to consideration of hydraulic developments for purposes of power or irrigation and to details and construction of hydraulic machinery.

*Text.*

*Mead:—"Water Power Engineering."*

**162—Sewerage and Sewage Disposal.**

*Fourth Year, Second Semester, Fifteen Weeks, Three Hours per Week.*

A course devoted to the study of various systems for the removal of sewerage; the quantity and character of sewage; effect of rainfall; size and form of sewers; methods of sewage disposal; cost and methods of construction.

*Texts.*

*Folwell*:—"Sewerage."

*Kinnicutt, Winslow, and Pratt*:—"Sewage Disposal."

**173—Sewer Design.**

*Fourth Year, Second Semester, Fifteen Weeks. Three Hours per Week.*

A drawing room course devoted to the design of part of a sewerage system for a city.

**174—Structures III.**

*Fourth Year, First Semester, Fifteen Weeks, Three Hours per Week.*

This course is a continuation of course 105 and is devoted to the computation and design of structures of wood and steel. The subjects treated are plate-girders, and various roof and bridge trusses.

*Text.*

*Spofford*:—"Theory of Structures."

**175—Structures III.**

*Fourth Year, Second Semester, Fifteen Weeks, Three Hours per Week.*

A continuation of Course 174, including also a study of retaining walls, masonry dams, arches, and reinforced concrete.

*Texts.*

*Spofford*:—"Theory of Structures."

*Hool*:—"Reinforced Concrete Construction."

**176—Structural Design I.**

*Fourth Year, First Semester, Fifteen Weeks, Nine Hours per Week.*

A drawing room course in which students apply the principles studied in Course 174 to problems in design.

**177—Structural Design II.**

*Fourth Year, Second Semester, Fifteen Weeks, Nine Hours per Week.*

A continuation of Course 176. The work covered in the two courses usually consists of the design of a wooden truss, a plate girder, a riveted or pin-connected truss, and several smaller designs in concrete.

**191—Contracts.**

*Third Year, Second Semester, One Hour per Week.*

See Dept. of Electrical Engineering, p. 36.

### 600—Technical Writing.

*Third Year, Second Semester, Fifteen Weeks, Two Hours per Week.*

The aim of this course is to train the engineering student in the special application of English composition to such demands as will be most frequently made upon him in practical life.

He is supposed to be familiar with the rules and practice of general composition and to be acquainted with some portion of good English literature. In this course the main stress will be laid upon the proper preparation of technical reports, articles for technical magazines, specifications, papers for professional societies, patent specifications, and other such literary efforts as frequently fall to the lot of the professional engineer.

#### *References.*

*Earle*:—"Theory and Practice of Technical Writing."

*Rickard*:—"A Guide to Technical Writing."

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## IV—DEPARTMENT OF MINING ENGINEERING.

### 400-401—Quantitative Analysis.

*Third Year, First and Second Semesters, Fifteen Weeks, Nine Hours a Week.*

The aim of this course is to instruct the student with the theory and practice of representative methods of gravimetric and volumetric quantitative analysis. A high standard of accuracy is required in most of the work so that the student may be qualified to make

analysis of the refinement demanded in umpire work. Toward the end of the course, the student is familiarized with some commercial methods for analyzing ores, slags, and metallurgical products, and is required to make a certain number of determinations within a time limit. Reports must be written as experiments progress and handed in at the end of every week, otherwise full value for the work cannot be obtained. Each student is required to make a deposit of \$5.00 at the opening of the season to cover breakage during the year.

The following analysis are included in the course and are supplemented with extra work according to the rapidity with which each individual accomplishes the tasks:

Water, sulphur, and magnesia in crystallized magnesium sulphate; iron, gravimetrically, in ferrous ammonium alum; silica, iron and alumina, calcium and magnesium in limestone or dolomite; lead, copper, and zinc in brass; preparation of normal solutions; alkalinity of soda ash, acid strength of oxalic acid, iron in ore by bichromate and permanganate methods; silica, sulphur, phosphorus, iron in iron ore; carbon, sulphur, silicon manganese and phosphorus in steel and pig iron; zinc, copper, lead, antimony, tungsten and arsenic in ores; tin in bearing metal; slag analysis, flue gas analysis; sulphur in coal, proximate analysis of coal, calorific power of coal.

*Texts:*

*Mahin*:—"Quantitative Analysis."

*Talbot*:—"Quantitative Analysis."

*Lord and Demorest*:—"Metallurgical Analysis."

**402—Quantitative Analysis.**

*Third Year, Fifteen Weeks, Two Hours a Week in First Semester, and One Hour in the Second Semester.*

This is a course of lectures to accompany courses 400-401. It covers the work done in the laboratory and includes discussions of quantitative separations from a theoretical standpoint, as well as chemical calculations and a short course in Elementary Physical Chemistry.

*Text.*

*Talbot and Blanchard:—"Electrolytic Dissociation Theory."*

**403-404—Metallurgical Laboratory.**

*Fourth Year, First and Second Semester, Fifteen Weeks, Eight Hours per Week.*

This consists of metallurgical and mill tests and reports. Some of the tests are merely illustrative of processes and some are made with half-size regular furnaces and mill apparatus. Full reports are required, in every case, within two weeks from the completion of an experiment or test. A large amount of assaying is necessary in determining the distribution of values and losses in the products made in the different tests, and this makes the student more proficient as an assayer.

Most of the following tests are carried out by the students in the fourth year:

High temperature measurements. Determination of the calorific power of fuels. Temperature limits of hardening power of steel. Oxidizing roast of a sulphide ore. Melting points of silicates. Corrosion of

refractories by silicates. Copper selecting process. Cyanide process, leaching and slime treatment. Gold amalgamation test. Silver pan amalgamation. Lead or copper smelting in the blast furnace. Cupellation of base bullion. Refining of copper. Gold stamp mill run. Concentration by jigging with previous sizing and with classification. Wilfley table concentration. Vanner concentration.

#### 405—Structural Geology.

*Third Year, Second Semester, Fifteen Weeks, Three Hours per Week.*

*Field Work, one week in Summer School of Mining.*

This course deals with rocks, rock classifications and structures, and one hour per week will be spent in the laboratory. Introductory lectures will be given on the optical properties of minerals and the study of rocks will be illustrated by their sections under the microscope, but particular attention will be given to megascopic characteristics. This will be followed by a study of jointing, folding, and faulting; estimation of dip, strike, and thickness of beds; field methods and method of constructing geological maps and sections.

*Text.*

*Pirsson*:—"Rocks and Rock Minerals".

*References.*

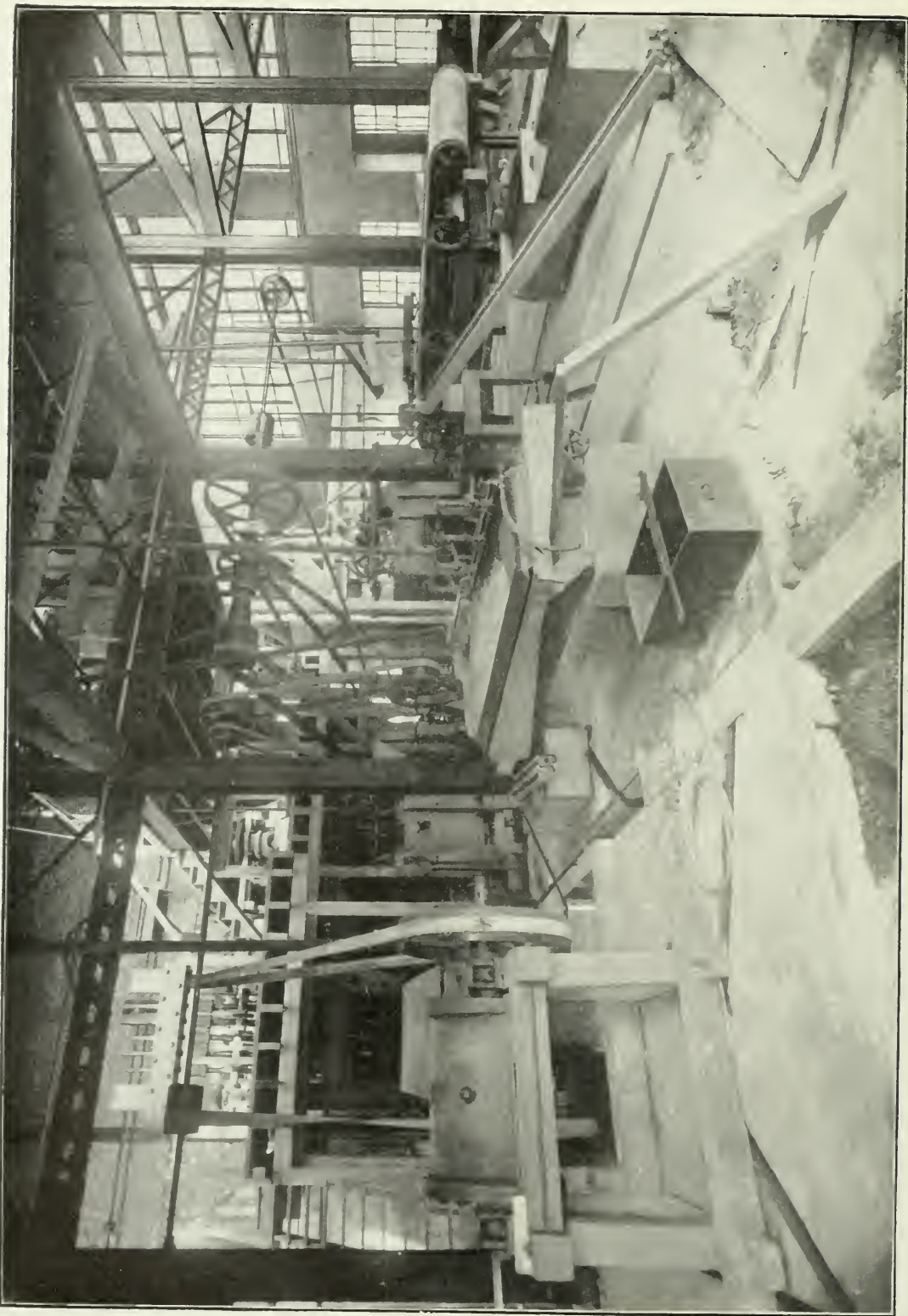
*Farrell-Moses*:—"Practical Field Geology."

*Hayes*:—"Handbook for Field Geologists."

*Spurr*:—"Geology Applied to Mining,"

*Geikie*:—"Structural Geology."





**406—Mineralogy.**

*Third Year, Second Semester, Fifteen Weeks, Five Hours per Week.*

This course includes descriptive and determinative mineralogy.

The time will be largely given to laboratory work in order to train the student to determine minerals accurately and rapidly by their physical and chemical properties, to make him thoroughly acquainted with the appearance, properties, uses, and association of the more important mineral species.

The determinative mineralogy begins with drill in the methods of blow-pipe analysis with a view to preparing the student for the practical determination of the more important ore-making minerals.

This is followed by determinative mineralogy proper.

*Texts.*

*Moses and Parsons*:—"Crystallography, Mineralogy, and Blow-pipe Analysis."

*References.*

*Brush and Penfield*:—"Manual of Determinative Mineralogy and Blow-pipe Analysis."

*Dana*:—"Text-Book of Mineralogy."

**407—Economic Geology.**

*Fourth Year, First Semester, Fifteen Weeks, Two Hours per Week.*

A brief outline of Geology of Canada, followed by a study of the distributions and mode of occurrence

of coal, petroleum, and natural gas; description and production of Canadian deposits with particular attention to the coal fields of Nova Scotia.

This is followed by a discussion of the general features and formation of ore deposits; the cause of formation of cavities in rocks; their relation to ore bodies and a discussion of the theory of ore deposition.

*Text.*

*Lindgren*:—"Mineral Deposits."

*References.*

Reports of Geological Survey and Mines Branch of the Canadian Department of Mines.

#### **408—Economic Geology.**

*Fourth Year, Second Semester, Fifteen Weeks, Two Hours per Week.*

A continuation of discussion of ore deposits, distribution, production and description of placer deposits; the non-metallic minerals and their uses, including clays, gypsum, salines, fertilizers, abrasives and minor minerals; the metallic minerals, iron, copper, lead, zinc, silver, and gold, with particular attention to the gold-bearing formation of Nova Scotia.

The student will be requested to read and abstract prescribed articles appearing in the mining journals and transactions of mining societies.

*Text.*

*Lindgren*:—"Mineral Deposits."

*References.*

*Kemp*:—"Ore Deposits of United States and Canada."

*Beck*:—"Nature of Ore Deposits."

*Ries*:—"Economic Geology."

Reports of Geological Surveys of Canada and the United States.

**409—General Geology.**

*Third Year, Second Semester, Fifteen Weeks, Three Hours per Week.*

*A Special Course for Students in Civil Engineering.*

A general discussion of dynamical and structural geology. A study of rock-forming minerals with practical work with rock collections.

The principles of Geology will be treated with special reference to the needs of Civil Engineers.

*Text.*

*Ries and Watson*:—"Engineering Geology."

*Reference.*

*Scott*:—"Introduction to Geology."

**415—Mine Surveying.**

*Third Year, First Semester, Fifteen Weeks, Three Hours per Week.*

This course aims to acquaint the student with the special adaptations of surveying instruments and practices that are common in mine surveying.

Mine surveying instruments and accessories, underground stations, carrying a meridian underground, survey of secondary openings, survey record, use of mine maps, plotting mine maps, map filing, bore-hole surveys.

*Text:*

*Trumbull*:—"Underground Surveying."

*References.*

*Brough*:—"Mine Surveying,"

*Lupton*:—"Mine Surveying."

#### **420—Assaying.**

*Third Year, Second Semester, Fifteen Weeks, Six Hours per Week.*

The purpose of this course is to acquaint the student with the theory and practice of modern fire assaying. The training also prepares the student for the course in metallurgical laboratory, where he is required to trace the ore values through the mill runs and metallurgical tests that make up the latter. It also prepares him to quickly become an expert assayer after he leaves college, if he starts his engineering practice in such a position.

Lectures are given from time to time covering the following points: assay furnaces, tools, reagents, sampling, weighing, reduction and oxidation reactions, slag formation; the various methods of crucible fusion, scorification, cupellation, parting, and special methods for special ores and metallurgical products.

Reports will be required weekly, and must be kept up to date, otherwise full value for the work cannot be obtained.

The following assays are required:—Reducing power, silver ores by scorification and crucible assay, gold ores by pot and muffle furnace fusion, lead ores by crucible fusion, ores with metallics, base and doré bullion, cyanide solutions, pig or blister copper, special ores and metallurgical products.

*Text:*

*Fulton:*—"Fire Assaying."

*References.*

*Lodge:*—"Notes on Assaying."

*Austin:*—"Fire Assay."

*Bugbee:*—"Notes on Fire Assaying."

### **425—Principles of Metallurgy.**

*Third Year, First Semester, Fifteen Weeks, Three Hours per Week.*

This course deals with metals, furnaces, fuels, and typical metallurgical processes, agents, and products. It serves as an introduction to the course in the second semester of the junior year on metallurgy of non-ferrous metals and also to the course on the metallurgy of iron and steel.

The general subjects treated in detail are as follows:

Fundamental principles of modern metallurgy; physical properties of the metals; alloys; combustion and fuels; heat utilization; measurement of high temperatures and refractories.

Especial emphasis is placed on the study of the heating values of different coals.

*Text.*

*Hofman*:—"General Metallurgy."

*References.*

*Roberts-Austen*:—"Introduction to the Study of Metallurgy."

*Sexton*:—"Fuel."

*Sexton*:—"Alloys."

*Damour-Queneau*:—"Industrial Furnaces."

*Goerens*:—"Introduction to Metallography."

*Juptner*:—"Heat, Energy, and Fuels."

**426—Non-Ferrous Metallurgy.**

*Third Year, Second Semester, Fifteen Weeks, Three Hours a Week.*

The main principles and modern practices of the metallurgy of the five principle metals are taken up in this course. The metals considered are copper, gold, lead, silver, and zinc. The main stress is laid upon copper and gold.

*Metallurgy of Copper*.—The subjects of roasting of copper ores, blast furnace, pyritic, and reverberatory furnace smelting, and slags; the production of metallic copper from matte, and the refining of copper are taken up in detail.

*Gold*.—This subject includes lectures, and study of stamp milling, chlorination; and cyanide process, and the production of gold bullion.

*Silver*.—The roasting of silver ores; pan amalgamation; hyposulphite leaching and cyanide processes are taken up in detail.

*Lead.*—Reverberatory smelting; roast smelting; open-hearth and blast furnace smelting are discussed and several lectures given on the desilverization of base bullion and cupellation.

*Zinc.*—The metallurgy of zinc is treated briefly.

*Texts.*

*Austin*:—"Metallurgy of Common Metals."

*McFarren*:—"Text Book of Cyanide Practice."

*References.*

*Schnabel-Louis*:—"Handbook of Metallurgy."

*Peters*:—"Principles of Copper Smelting."

*Peters*:—"Modern Copper Smelting."

*Julian & Smart*:—"Cyaniding of Gold and Silver Ores."

*Hofman*:—"Metallurgy of Lead."

*Collins*:—"Metallurgy of Silver,"

*Ingalls*:—"Metallurgy and Properties of Zinc."

## 427—Metallurgy of Iron and Steel.

*Fourth Year, First Semester, Fifteen Weeks, Three Hours per Week.*

In this course the metallurgy of iron and steel as carried out today is dealt with thoroughly. No obsolete practice is taken up unless it is deemed necessary for showing the development of a process. Much stress is laid upon metallurgical and thermal chemistry as applied to the iron and steel industry.

*Pig Iron*:—Ores, fuels, and fluxes, iron blast furnace and accessories, smelting practice, chemistry of process,

calculating blast furnace charge, comparison of process of purification of pig iron.

*Wrought Iron and Crucible Steel*:—Different processes of making wrought iron, elimination of impurities. Process and plant for making crucible steel, chemistry of processes.

*Acid and Basic Bessemer Steel*:—Plant and modern practice of acid and basic processes, chemistry and thermal efficiency of converters, comparison of two processes

*Acid and Basic Open-Hearth Steel*:—Open-hearth furnaces and accessories, acid and basic open-hearth furnaces and accessories, acid and basic open-hearth practice. Special open-hearth processes, duplex process, chemistry and thermal efficiency of processes.

*Mechanical Treatment of Steel*:—Forging, rolling, stamping, drawing, et. Rolling mill practice, heating furnaces.

*Iron and Steel Foundry*:—Making of molds, design of patterns, cupola furnaces, steel casting practice, malleable castings.

*Constitution of Iron and Steel*:—Solution theory as applied to metals and their alloys, freezing curves, Roozeboom diagram, micro-constituents of iron and steel, physical properties, effect of impurities on cast iron and steel.

*Heat Treatment of Steel*:—Annealing, hardening and tempering of steel, improper heat treatment, constituents of hardened and tempered steels.

*Special Steels.*

*Corrosion of Iron and Steel.*

*Electro-Metallurgy of Iron and Steel.*

*Text:*

*Stoughton*:—"Metallurgy of Iron and Steel."

*References.*

*Campbell*:—"Manufacture and Properties of Iron and Steel."

*Forsythe*:—"The Blast Furnace."

*Harbord*:—"Metallurgy of Steel."

*Sauveur*:—"Metallography of Iron and Steel."

*Howe*:—"Iron, Steel and Other Alloys."

#### **428—Metallurgy of Iron and Steel.**

*Fourth Year, First Semester, Lectures Two Hours a Week.  
Short Course for Civil, Electrical and Mechanical  
Engineers.*

This course covers the same subjects as are taken in course 427 but in an abridged form, with the exception of the following divisions, which are taken up in detail:—

Mechanical treatment of steel; iron and steel founding; constitution of iron and steel; corrosion of iron and steel.

The idea is to deal principally with the physical and chemical properties of iron and steel, rather than with the metallurgical processes of manufacture.

*Text.*

*Stoughton*:—"Metallurgy of Iron and Steel."

**429—Metallography of Iron and Steel.**

*Fourth Year, First Semester, One Afternoon per Week, Last Six Weeks.*

*Short Course for students taking 427 and 428.*

Microscopic study of iron and steel specimens. Effects of heat treatment of iron and steel, etc.

*Howe:—“Metallurgical Laboratory Notes.”*

**450—Exploration and Shaft Sinking.**

*Third Year, First Semester, Fifteen Weeks, Three Hours per Week.*

This course serves as an introduction to engineering as applied to mining. A syllabus of the material treated is practically as follows:

*Prospecting:—*Value of geology in prospecting, surface indications, trenching, trial pits, special indications of copper, iron, gold, zinc, coal etc., prospecting for gold by glacial indications in Nova Scotia.

*Boring:—*Hand augers, well-auger, American oil-well borer, Keystone driller, boring by percussion with rods, diamond drilling, shot drills. Surveying boreholes; costs.

*Shaft and Slope Sinking:—*Methods of drilling, firing and sinking, different methods of supporting circular and rectangular shafts, shaft timbering details, special methods of sinking in running ground, forepoling, sinking shoe with brick or concrete lining, tubbing, Poetsch freezing process, Kind-Chaudron process, caissons, cementation, cost of sinking shafts.

*Texts.*

*Donaldson*:—"Practical Shaft Sinking."

*Storms*:—"Timbering and Mining."

*Weatherbe*:—"Dredging for Gold in California."

**454—Excavation.**

*Third Year, Second Semester, Fifteen Weeks, Two Hours per Week.*

*Explosives*:—Gunpowder, composition of high explosives, such as gun cotton, nitroglycerin, dynamites, blasting gelatine, etc. Sprengel explosives, fulminates, "permitted" explosives, cartridges, detonators, fuses, care of explosives, theory of blasting, methods of drilling for excavations, electric machines for firing.

*Compressed Air Machinery*:—Wet and dry compressors, straight line and duplex, simple and compound (stage) compression, heat of compression, conveyance of compressed air, reheating, operating machinery using compressed air, valve details of various makes, indicator air-cards, duty and efficiency, receivers, various types of air drills as Darlington, Ingersoll, Rand, Sullivan, Holman, Leyner, etc. electric drills, coal under-cutting machines of puncher, disc, and chain types, tunneling machines, compressed air locomotives, compressed air auxiliary engines for hoisting, etc.

Daily problems are introduced into this course wherever possible.

*References.*

*Brunswick*:—"Explosives."

*De Kalb*:—"Manuel of Explosives."

*Peele*:—"Compressed Air Plant for Mines."

*Weston*:—"Rock Drills."

*Simons*:—"Compressed Air."

### 451—Exploitation, Haulage, and Pumping.

*Fourth Year, Second Semester, Fifteen Weeks, Three Hours per Week.*

*Exploitation*:—Opening up of deposits, choice of plan of working, shaft versus slope, adits, overhand and underhand stoping. Methods of working ore bodies, working out beds with permanent and with temporary pillars, pillar robbing, caving system, slicing methods, milling method, systems of filling, special methods applied to masses and thick ore bodies.

*Special Methods of Working Coal*:—Bord and pillar systems and various modifications, long wall, working steep seams, working contiguous seams, shaft pillars, subsidence, submarine mining.

*Mine Haulage*:—Cars, tracks, animal haulage; steam, air, and electric locomotive haulage; comparative costs. Wire rope haulage systems: details, adaptability, comparative cost of endless rope and main and tail rope haulage, back balances, mine tubs and aerial tramways. Hoisting, winch, windlass, and whim. Power machinery for hoisting; steam engines for hoisting, first second, and third motion geared engines, use of water wheels, gasolene engines and electric motors for hoisting. Cylindrical and conical drums, reels, various forms of hand, steam, and automatic brakes; methods and calculations for compensation, calculations for size of hoisting engine, Koepe and Whiting systems. Ropes, rope cappings, buckets, cages; pulleys, detaching hooks, safety clutches, keps, surface and underground arrangement of hoisting plant. Head frame and accessories, hoisting engines, calculation for size of engines, counterbalancing. Special methods of winding in coal mines.

*Pumping*:—Origin of underground water; drainage through adits. Cornish pumping engine and compressed air pumps; piston and plunger, inside and outside packed, duplex pumps; differential plunger pumps, compound and triple expansion pumps, power driven pumps, centrifugal pumps. Frenier pump, bucket lifts, pulsometers, air lift, rotary pumps. Different pump valve gears, as Cameron, Blake, Knowles, Worthington; costs of pumping. Dams; installation of pumping plants.

*Texts and References.*

*Foster*:—"Textbook of Ore and Stone Mining."

*Richards*:—"Mining Notes,"

*Ihlseng*:—"Manual of Mining."

*Hughes*:—"Text-book on Coal Mining."

*International Text-book Co.*:—"Coal Mining."

*Boulton*:—"Practical Coal Mining."

*Mayer*:—"Mining Methods in Europe."

*Hoover*:—"Principles of Mining."

*Brinsmeade*:—"Mining Without Timber."

## 452—Ventilating, Lighting, Accounting, and Valuation.

*Fourth Year, Second Semester, Fifteen Weeks, Three Hours per Week.*

*Ventilation*:—Gases met with in mines, coal-dust, laws of friction, theory of air currents, mechanical ventilators, details of different types, fan engines, motors and methods of connection, secondary ventilation, useful effect, efficiency. Stoppings, doors, brattice, regulators, air-crossings, losses in circulation, theory of splitting problems. Testing for various gases, explosive mixtures, natural ventilation by furnace, water blast and steam jets, fan ventilation; various types of fans as Guibal, Schiele, Capell, Nasmyth, Murphy, Waddle,

and Sirocco. Manometric efficiency. Production of air currents, regulators, laws of friction, splitting of air currents, calculations relative to splitting, equivalent orifice of a passage, summation of orifice in series, graphic method of orifices, mine explosions, mode of procedure to recover miners and mines, rescue breathing apparatus mine fires, cause and methods of suppression or exclusion.

*Lighting*:—Candles, torches, acetylene lamps. Naked lamps. Modern lamps, such as Ashworth-Heppelwhite, Muesseler, Marsaut, Wolf, Morgan, etc. Underground lighting stations. Delicate indicators, as Pieler, Chesneau, Stokes, Ashworth, Shaw.

*Accounting*:—Cashbook, journal, and ledger, and how to keep them. Distribution of expense and segregation of costs. Prime cost, maintenance, mine development and depreciation, renewal fund, sinking fund.

*Valuation*:—Sampling a mine, contamination of samples, calculation of results, estimation of probable value; examples.

#### *Texts and References.*

*Foster*:—"Textbook of Ore and Stone Mining."

*Richards*:—"Mining Notes,"

*Ihlseng*:—"Manual of Mining."

*International Text-book Co.*:—"Coal Mining."

Coal and Metal Miners' Pocket Book.

*Boulton*:—"Practical Coal Mining."

*Wallace*:—"Simple Mine Accounting."

*Rickard*:—"Sampling and Estimation of Ore in a Mine."

*Hoover*:—"Principles of Mining."

*Charlton*:—"American Mine Accounting."

*Finlay*:—"Cost of Mining."

*Herzig*:—"Mine Sampling and Valuing."

**453—Ore Dressing.**

*Fourth Year, First Semester, Fifteen Weeks, Three Hours per Week.*

It is the purpose of this course to acquaint the student with the general theory and principles that underlie the modern practice of ore dressing. The theories and principles are illustrated by machines and mills that represent the most advanced methods of the preparation of ores and the extraction of their values. The different types of machines are criticized and also the combination of machines that represent different milling practices.

*Crushing:*—Crushers, breakers, rolls, steam and gravity stamps, pulverizers, laws of crushing.

*Preliminary Washers:*—Sizing screens and principles of screen-sizing, classifiers, laws of classifying by free and hindered settling in water, hand-picking, jigs, laws of jigging, fine sand and slime concentrators, amalgamation, magnetic concentration, pneumatic concentrators, miscellaneous processes of separation.

*Accessory Apparatus:*—Bins, receiving floors, samplers, feeders, distributors, conveyers, elevators and wheels, pumps, launders, unwaterers, miscellaneous apparatus.

*Surface Plant:*—Power house and distribution, plant arrangement, tipples, screens, conveyors, bins, chutes, coal-washing plant and accessories, Robinson, Coppee, Luhrig, and Baum machines, coal-washing jigs and tables.

*Mill Processes and Management:*—Summary of principles of separation, study of different classes of milling practice from typical mills.

*General Ideas on Milling:*—Mill location, construction of buildings, power, power transmission, ventilation, lighting, labor, water, disposal of products, percentage extraction, limit of concentration, accounts and reports, losses and costs, testing an ore for a process.

*Text.*

*Richards:*—"Ore Dressing."

#### **460—Mill Construction.**

*Fourth Year, First Semester, Six Weeks, Five Hours per Week.*

This course treats of the construction and equipment of mill and smelter buildings. It includes information on such structures as are required for sampling plants, ore concentrators, steel mills, stamp mills copper and lead smelters, etc. The course is designed to cover the great number of practical details which the mining engineer frequently needs in construction work, especially in isolated localities.

Attention will be given to such practical details as are outlined below:

Erecting building and machinery foundations, concrete construction, wooden and steel mill construction, saw-tooth roof construction, head frames, trusses and trestles, coal tipples, roof coverings, laying out shafting, pulleys, belts and belting, erection of machines, pipe-fitting, setting of boilers, setting of turbines, lighting of mill buildings, installation of machinery, maintenance, depreciation.

Mechanism, mechanical powers, shafts, couplings, bearings, clutches, transmission of power by belts, ropes, friction gears, chains, and cams.

*References.*

*Kidder*:—"Architects' and Builders' Pocket-Book."

*Hobart*:—"Millwrighting."

*Ingalls*:—"Notes on Metallurgical Mill Construction."

*Ketchum*:—"Design of Mill Structures."

**461—Mine Plant Design.**

*Fourth Year, First and Second Semesters, Six Hours per Week.*

In this course the student is required to design some actual small plant, or some portion of a small plant, as would be necessary in the development of a mining or metallurgical enterprise. Working drawings of some such plant or accessory as a stamp mill, steel or wooden head frame, concentration plant, smelter building, skip, cage, head frame, ore bin, or bank head, etc., are prepared. The drawings must be supplemented also by bills of material, specifications, and estimates.

**465—Thesis.**

*Fourth Year, Second Semester, Fifteen Weeks, Eight Hours per Week.*

This consists of an elementary, original investigation into some mining or metallurgical problem. This is intended to acquaint the student with the methods of scientific investigations, so that he will know how to tackle problems that arise in engineering work. The student must choose his subject before the end of the first semester of the fourth year. He must prepare a card catalogue and abstracts of the literature bearing on his problem and prepare a thorough complete report on the work in acceptable form.

### **466—Summer Course in Mining.**

*Third or Fourth Year, Summer Vacation, Four to Six Weeks of Observation, Sketching, etc., at Typical Mines and Plants.*

This course which lasts from four to six weeks in the summer consists in visits to typical mining and metallurgical plants in operation in Nova Scotia. The first week is spent in geological surveying and mapping of some interesting quadrangle. The rest of the time is spent in practical mine surveying, observation, note-taking, and sketches of various metal mining, ore concentration, coal mining, iron smelting or steel works, which there are splendid examples in this province. Notes and sketches are written up in the evening. A full neat report with sketches is required to be handed in by the students at the beginning of the autumn semester.

### **600—Technical Writing.**

See Dept of Civil Engineering, p. 61.

### **Coal Mining Engineering.**

This course is called "*The Coal Mining Engineers' Option of the Regular Course in Mining Engineering.*" It is for the benefit of those students who wish to fit themselves as mining engineers for the coal mining industry.

*In the Third Year, First Semester*, time is taken from chemistry of the work and applied to the mechanical and electrical course.

*In the Third Year, Second Semester*, time is taken from assaying and chemistry and given to work in steam and electrical machinery.

*In the Fourth Year, First Semester*, time is taken from metallurgical laboratory, etc., and given over to work in electrical distribution, alternating currents, etc.

*In the Fourth Year, Second Semester* extra time is given to steam and gas power plants at the expense of metallurgical laboratory.

This course should enable a man to prepare himself to meet the problems arising in and around collieries in the mechanical, electrical or mining branches of engineering. The course is based upon the experience of some of the oldest of the established technical colleges in this line, and we present it with a belief that it will prepare men to become efficient colliery superintendents and managers. At the successful completion of the course a degree of Bachelor of Science is awarded to the student. The course will be given in any year when two students apply for the privileges of the same. For a tabulated statement of this option, see p.96

### **Military Instruction,**

#### **500—Mapping, Organization, Tactics.**

*Third Year, First Semester, Four Weeks, One Hour per Week.*

#### **"A." Map Reading and Field Sketching.**

The subject matter of Part I. of the "Manual of Map Reading and Field Sketching."

#### **"B." Military Administration and Organization.**

*Third Year, First Semester, Three Weeks, One Hour per Week.*

The administration, organization, equipment, establishment, terms of service, and pay of the Canadian Militia for both peace and war.

*Texts.*

"King's Regulations and Orders for the Canadian Militia."

"Field Service Regulations," Part II. (Organization and Administration.)"

"Field Service Pocket Book."

**Tactics.**

*Third Year, First Semester, Eight Weeks, One Hour per Week.*

Tactics as contained in "Field Service Regulations" Part I. (Operations).

The application of tactical principles to schemes worked out on a map.

**"A." Military History.**

*Third Year, Second Semester, Four Weeks, One Hour per Week.*

The strategy and general conduct of a selected campaign.

The study of this campaign with reference to the principles laid down in Field Service Regulations.

*Text.*

Official History of the selected campaign.

**“B.” Coast Defence Electric Lighting.**

*Third Year, Second Semester, Four Weeks, Two Half-hours per Week.*

Principles of coast defence, with special reference to electric lighting apparatus in the service used in connection with defence electric lights.

*Text Book.*

“Military Electric Lighting”; Vol. II.

**“C.” Field Engineering.**

*Third Year, Second Semester, Ten Weeks, One Hour and Two Half-hours per Week.*

The role of engineers in active service.

The subject matter of the Manual of Field Engineering and the applications of its principles to schemes worked out on the map.

*Texts.*

“Manual of Field Engineering.”

“Field Service Pocket Book.”

**510—Physical Training.**

*Third Year, First Semester, Two Half-Hours per Week.*

*Text Book.*

“Syllabus of Physical Exercises for Schools” (Canada).

## Land Surveying.

*Short Course, Two Months, January and February.*

This course for land surveyors is intended for beginners who wish to qualify themselves for Provincial Land Surveyors. It will cover the following range of subjects;

1. Study of common surveying instruments, such as compass, level and transit.
2. Adjustment of these instruments.
3. Use of these instruments in making land surveys.
4. Approved methods of keeping field notes.
5. Office calculations based on field notes.
6. Methods of mapping surveys of land.
7. Determination of true north.
8. Topographic surveying and plotting.

It is expected that the student will acquire the ability to survey quickly and independently any ordinary piece of farm or timber land, or mining area. It is also expected that he will learn how to do the ordinary office calculations quickly and accurately, make neat accurate plans of surveys and be able to describe and mark the boundaries of any certain area surveyed by him, so that there is no possibility of a misunderstanding arising afterwards in this connection. It is only necessary for the applicant to have a fair working knowledge of English composition and plane trigonometry.

A detailed outline of the different subjects taught in the lectures, recitations, problems, and field work is as follows:—

Measurement of lines by pacing, chaining, or taping; angular measurements with hand compass; verniers and their uses in linear and circular measurements; the compass and its use in surveying; bearing and azimuths; declination of the magnetic needle and its variations; dip of needle; the transit, its adjustments and its uses; errors, their source and prevention, field notes and office calculations; traverses, latitude and departure, checks; methods of plotting, parting of land; re-running of old lines; methods of locating a point; passing obstacles; other difficulties met in surveying practice; highway surveys; leveling; datum; form of notes; check hand level and its uses; wye and Dumpy levels, care and adjustment; target and vernier; difficult leveling, profile leveling; leveling for drainage and highways; computation of earthwork; determination of true north, determination by observation on polaris, solar attachment, use of nautical almanac, determination by observation on sun.

Topographic maps and their value; methods of topographic surveying; contours; contour intervals. Triangulation; base-line etc., Stadia surveying; stadia wires; stadia rods; value of stadia in topographic work; reduction of readings.

Drafting:—modern office methods, use and care of drawing instruments, lettering, plotting, plain and topographic mapping, contouring, conventional signs, tracing, blueprinting, uses of planimeter and pantograph.

Organization and equipment of field parties and duties of members.

The fee for this course will be fifteen dollars (\$15.00), payable in advance. The entire equipment of the department of Civil Engineering will be available for this course.

### Highway Construction.

*Short Course, Two Weeks in February.*

This course is free. It is designed especially for road inspectors and road superintendents, and all others who are vitally concerned in the construction and maintenance of rural highways. The course will be as practical as possible, and will not be too technical for any one to follow and profit by. Theory will be left in the background as much as possible, and the course will deal with actual construction and results. Special attention will be laid on the cost of various operations and various kinds of construction. Some practical outside work will be done in learning the use of the hand level in laying out grades and in testing different road materials.

CIVIL ENGINEERING.

Engineering Camp  
three weeks field practice.

THIRD YEAR

FIRST SEMESTER

| SUBJECTS                           | Reference No.       | Weeks | Hours per Week          |                        | For details see |        | Pre-Requisites, Etc.  |
|------------------------------------|---------------------|-------|-------------------------|------------------------|-----------------|--------|-----------------------|
|                                    |                     |       | Lectures and Class Room | Field Lab. or Drafting | Page            | Course |                       |
| Mechanics of Engineering I.....    | Mechanics 1.....    | 15    | 5                       | .....                  | 52              | 101    | Third Year Entrance   |
| Advanced Surveying I.....          | Civil Eng. 1.....   | 15    | 1                       | 3                      | 54              | 119    | Third Year Entrance   |
| Railroad Engineering I.....        | Civil Eng. 2.....   | 15    | 4                       | .....                  | 55              | 121    | Third Year Entrance   |
| Steam Eng. Turbines & Boilers..... | Thermo. 1.....      | 15    | 3                       | .....                  | 41              | 301    | Third Year Entrance   |
| Mechanical Eng. Laboratory.....    | Mech. Eng. 3.....   | 15    | 1                       | 3                      | 45              | 350    | Concurrent with 301   |
| Electrical Machinery.....          | Elec. Eng. 1A.....  | 15    | 3                       | .....                  | 31              | 201-A  | Third Year Entrance.  |
| Electrical Laboratory.....         | Elec. Eng. 2.....   | 15    | .....                   | 3                      | 34              | 250    | Concurrent with 201-A |
| Military Science.....              | Mil. Science 1..... | 15    | 1                       | .....                  | 83              | 500    | Third Year Entrance   |
| Physical Training.....             | .....               | 15    | .....                   | 1                      | 85              | 510    | .....                 |

THIRD YEAR

SECOND SEMESTER

| SUBJECTS                         | Reference No.       | Weeks  | Hours per Week          |                        | For details see |        | Pre-Requisites, Etc. |
|----------------------------------|---------------------|--------|-------------------------|------------------------|-----------------|--------|----------------------|
|                                  |                     |        | Lectures and Class Room | Field Lab. or Drafting | Page            | Course |                      |
| Mechanics of Engineering II..... | Mechanics 2.....    | 1st. 9 | 5                       | .....                  | 53              | 102    | 101                  |
| Materials Testing.....           | Mechanics 3.....    | 15     | .....                   | 3                      | 53              | 103    | Concurrent with 102. |
| Structures I.....                | Civil Eng. 3.....   | Last 6 | 5                       | .....                  | 53              | 105    | 102                  |
| Advanced Surveying.....          | Civil Eng. 4.....   | 15     | 2                       | 3                      | 55              | 120    | 119                  |
| Railroad Engineering II.....     | Civil Eng. 5.....   | 15     | 3                       | .....                  | 56              | 122    | 121                  |
| Highway Engineering.....         | Civil Eng. 6.....   | 10     | 2                       | .....                  | 57              | 131    | Third Year Entrance  |
| Electrical Machinery.....        | Elec. Eng. 4A.....  | 15     | 3                       | .....                  | 31              | 202-A  | 201-A                |
| Military Science.....            | Mil. Science 2..... | 15     | 2                       | .....                  | 84              | 501    | 500                  |
| General Geology.....             | Geology 5.....      | 15     | 3                       | .....                  | 67              | 409    | Third Year Entrance  |
| Technical Writing.....           | English 1.....      | 15     | 2                       | .....                  | 61              | 600    | Third Year Entrance  |

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## FIRST SEMESTER

## CIVIL ENGINEERING.

## FOURTH YEAR

Engineering Camp  
Three weeks field practice.

| SUBJECTS                         | Reference No.      | Weeks | Hours per Week         |                        | For details see |        | Pre-Requisites, Etc. |
|----------------------------------|--------------------|-------|------------------------|------------------------|-----------------|--------|----------------------|
|                                  |                    |       | Lecture and Class Room | Field Lab. or Drafting | Page            | Course |                      |
| Theoretical Hydraulics.....      | Hydraulics 1.....  | 15    | 3                      | .....                  | 54              | 111    | 101-102              |
| Hydraulic Laboratory.....        | Hydraulics 2.....  | 15    | .....                  | 3                      | 54              | 112    | Concurrent with 111  |
| Railroad Design.....             | Civil Eng. 7.....  | 15    | .....                  | 3                      | 56              | 124    | 121                  |
| Masonry Construction.....        | Civil Eng. 8.....  | 15    | 2                      | .....                  | 57              | 141    | 102                  |
| Materials Testing.....           | Mechanics 4.....   | 15    | .....                  | 3                      | 57              | 142    | Concurrent with 141  |
| Structures II.....               | Civil Eng. 9.....  | 15    | 3                      | .....                  | 59              | 174    | 105                  |
| Structural Design I.....         | Civil Eng. 10..... | 15    | .....                  | 9                      | 60              | 176    | Concurrent with 174  |
| Metallurgy of Iron and Steel.... | Metallurgy 3.....  | 15    | 2                      | .....                  | 73              | 428    | Third Year Entrance  |

## FOURTH YEAR

## SECOND SEMESTER

| SUBJECTS                          | Reference No.      | Weeks | Hours per Week         |                        | For details see |        | Pre-Requisites, Etc. |
|-----------------------------------|--------------------|-------|------------------------|------------------------|-----------------|--------|----------------------|
|                                   |                    |       | Lecture and Class Room | Field Lab. or Drafting | Page            | Course |                      |
| Water Supply.....                 | Civil Eng. 11..... | 15    | 3                      | .....                  | 58              | 151    | 111-112              |
| Hydraulic Design.....             | Civil Eng. 12..... | 15    | .....                  | 2                      | 58              | 152    | Concurrent with 151  |
| Hydraulic Engineering.....        | Hydraulics 3.....  | 15    | 3                      | .....                  | 58              | 153    | 111-112              |
| Sewerage & Sewerage Disposal..... | Civil Eng. 13..... | 15    | 3                      | .....                  | 59              | 162    | 111-112              |
| Sewer Design.....                 | Civil Eng. 14..... | 15    | .....                  | 3                      | 59              | 163    | Concurrent with 162  |
| Structures III.....               | Civil Eng. 15..... | 15    | 3                      | .....                  | 60              | 175    | 174                  |
| Structural Design II.....         | Civil Eng. 16..... | 15    | .....                  | 9                      | 60              | 177    | Concurrent with 175  |
| Contracts and Specifications..... | Contracts.....     | 15    | 1                      | .....                  | 60              | 191    | Third Year Entrance  |

THIRD YEAR. MECHANICAL AND ELECTRICAL ENGINEERING. FIRST SEMESTER.

| SUBJECTS                       | Reference No.  | Hours per Week |                         |                         | For details see |        | Pre-Requisites, Etc. |
|--------------------------------|----------------|----------------|-------------------------|-------------------------|-----------------|--------|----------------------|
|                                |                | Weeks          | Lectures and Class Room | Field Lab. and Drafting | Page            | Course |                      |
| Elec. Machinery                | Elec. Eng. 1   | 15             | 3                       | .....                   | 30              | 201    | Third Year Entrance  |
| Elec. Engineering Laboratory   | Elec. Eng. 2   | 15             | .....                   | 3                       | 34              | 250    | Concurrent with 201. |
| Steam Eng., Turbines & Boilers | Thermo 1A      | 15             | 4                       | .....                   | 41              | 301A   | Third Year Entrance  |
| Mech. Eng. Laboratory          | Mech. Eng. 3   | 15             | 1                       | 3                       | 45              | 350    | Concurrent with 301  |
| Mechanics of Eng. 1            | Mechs. 1       | 15             | 5                       | .....                   | 51              | 101    | Third Year Entrance  |
| Military Science               | Mil. Science 1 | 15             | 1                       | .....                   | 83              | 500    | Third Year Entrance  |
| Mach. Design & Drawing         | Mech. Eng. 2   | 15             | .....                   | 6                       | 48              | 331    | Third Year Entrance  |
| Machine Design Theory          | Mech. Eng. 1   | 15             | 3                       | .....                   | 47              | 329    | Third Year Entrance  |
| Physical Training              | .....          | 15             | .....                   | 1                       | 85              | 510    | Third Year Entrance  |

THIRD YEAR

| SECOND SEMESTER            |                |        |                         |                         |                 |        |                      |  |  |
|----------------------------|----------------|--------|-------------------------|-------------------------|-----------------|--------|----------------------|--|--|
| SUBJECTS                   | Reference No.  | Weeks  | Hours per Week          |                         | For details see |        | Pre-Requisites, Etc. |  |  |
|                            |                |        | Lectures and Class Room | Field Lab. and Drafting | Page            | Course |                      |  |  |
|                            |                |        |                         |                         |                 |        |                      |  |  |
| Elec. Machinery            | Elec. Eng. 4   | 15     | 3                       | .....                   | 30              | 202    | 201                  |  |  |
| Elec. Eng. Laboratory      | Elec. Eng. 5   | 15     | .....                   | 3                       | 34              | 251    | 250 and 201.         |  |  |
| Thermodynamics             | Thermo. 2A     | 15     | 4                       | .....                   | 42              | 302A   | 301                  |  |  |
| Mech. Eng. Laboratory      | Mech. Eng. 4   | 15     | 1                       | 3                       | 45              | 351    | 301 and 350          |  |  |
| Mechanics of Eng. II       | Mechs. II      | 1st 9  | 5                       | .....                   | 51              | 102    | 101                  |  |  |
| Materials Testing          | Mechs. III     | 15     | .....                   | 3                       | 51              | 103    | Concurrent with 102  |  |  |
| Structures 1               | Civil Eng. 3   | Last 6 | 5                       | .....                   | 51              | 105    | 101 and 102.         |  |  |
| Mil. Science               | Mil. Science 2 | 15     | 2                       | .....                   | 83              | 501    | 500.                 |  |  |
| Machine Design and Drawing | Mech. Eng. 5   | 15     | .....                   | 6                       | 48              | 332    | 329 and 331.         |  |  |
| Machine Design Theory      | Mech. Eng. 2A  | 15     | 2                       | .....                   | 47              | 330    | 329                  |  |  |
| Technical Writing          | English I      | 15     | 2                       | .....                   | 61              | 600    | Third Year Entrance  |  |  |



FOURTH YEAR MECHANICAL AND ELECTRICAL ENGINEERING. SECOND SEMESTER

| SUBJECTS                      | Reference No.     | Weeks | Hours per Week          |                         | For details see |        |   | Credit              | Pre-Requisites, Etc. |
|-------------------------------|-------------------|-------|-------------------------|-------------------------|-----------------|--------|---|---------------------|----------------------|
|                               |                   |       | Lectures and Class Room | Field Lab. and Drafting | Page            | Course |   |                     |                      |
| Contracts and Specifications. |                   |       |                         |                         |                 |        |   |                     |                      |
| Hydraulic Engineering.....    | Contracts 1....   | 15    | 1                       | .....                   | 36              | 270    | 1 | Third Year Entrance |                      |
| Electrical Distribution.....  | Hydraulics 3....  | 15    | 3                       | .....                   | 40              | 153    | 3 | 111                 |                      |
| Machine Design & Drawing..    | Elec. Eng. 15.... | 15    | 3                       | .....                   | 32              | 209    | 3 | 203                 |                      |
| Elec. Eng. Abstracts.....     | Mech. Eng. 16.... | 15    | 3                       | .....                   | 49              | 334    | 2 | 333 or 333A         |                      |
|                               | Elec. Eng. 3....  | 15    | 1                       | .....                   | 32              | 208    | 1 | .....               |                      |
| Elec. Engineering Option      |                   |       |                         |                         |                 |        |   |                     |                      |
| Elec. Railways.....           | Elec. Eng. 16.... | 15    | 2                       | .....                   | 33              | 211    | 2 | 202-203             |                      |
| Elec. Eng. Laboratory.....    | Elec. Eng 12....  | 15    | .....                   | 3                       | 35              | 253    | 1 | 252                 |                      |
| Alternating Currents.....     | Elec. Eng. 11.... | 15    | 3                       | .....                   | 31              | 204    | 3 | 203                 |                      |
| Electrical Design.....        | Elec. Eng. 17.... | 15    | .....                   | 3                       | 34              | 212    | 1 | 203                 |                      |
| Mechanical Eng. Option        |                   |       |                         |                         |                 |        |   |                     |                      |
| Steam Turbines.....           | Mech. Eng. 10.... | 15    | 2                       | .....                   | 44              | 305    | 2 | 302                 |                      |
| Gas Engines.....              | Mech. Eng. 11.... | 15    | 3                       | .....                   | 45              | 306    | 3 | 302                 |                      |
| Mech. Eng. Laboratory.....    | Mech. Eng. 17.... | 15    | 1                       | .....                   | 38              | 353    | 2 | 352                 |                      |
| Mechanical Design.....        | Mech. Eng. 19.... | 15    | .....                   | 3                       | 50              | 336    | 1 | 333                 |                      |

## FIRST SEMESTER

## MINING ENGINEERING.

## THIRD YEAR.

Engineering Camp  
Three weeks Field practice.

| SUBJECTS                             | Reference No.       | Weeks | Hours per Week         |                        | For details see |        | Pre-Requisites, Etc. |
|--------------------------------------|---------------------|-------|------------------------|------------------------|-----------------|--------|----------------------|
|                                      |                     |       | Lecture and Class Room | Field Lab. or Drafting | Page            | Course |                      |
| Mechanics of Engineering I.....      | Mechanics 1.....    | 15    | 5                      | .....                  | 52              | 101    | Third Year Entrance  |
| Steam Eng. Turbines and Boilers..... | Thermo 1-A.....     | 15    | 4                      | .....                  | 41              | 301-A  | Third Year Entrance  |
| Mech. Eng. Laboratory.....           | Mech. Eng. 3.....   | 15    | .....                  | 3                      | 45              | 350    | Third Year Entrance  |
| Quantitative Analysis.....           | Chemistry 1.....    | 15    | 1                      | 9                      | 61              | 400    | Third Year Entrance  |
| Mine Surveying.....                  | Mining 7.....       | 15    | 3                      | .....                  | 67              | 415    | Engineering Camp     |
| Principles of Metallurgy.....        | Metallurgy 1.....   | 15    | 3                      | .....                  | 69              | 425    | Third Year Entrance  |
| Mineralogy.....                      | Geology 2.....      | 15    | 2                      | 3                      | 65              | 406    | Third Year Entrance  |
| Military Science.....                | Mil. Science 1..... | 15    | 1                      | .....                  | 83              | 500    | Third Year Entrance  |
| Physical Training.....               | .....               | 15    | .....                  | 1                      | 85              | 510    | Third Year Entrance  |

## SECOND SEMESTER

## THIRD YEAR

| SUBJECTS                           | Reference No.     | Weeks | Hours per Week         |                        | For details see |        | Pre-Requisites, Etc. |
|------------------------------------|-------------------|-------|------------------------|------------------------|-----------------|--------|----------------------|
|                                    |                   |       | Lecture and Class Room | Field Lab. or Drafting | Page            | Course |                      |
| Mechanics of Engineering II.....   | Mechanics 2.....  | 9     | 5                      | .....                  | 53              | 102    | 101                  |
| Structures 1.....                  | Civil Eng. 3..... | 6     | 5                      | .....                  | 53              | 105    | 101                  |
| Materials Testing.....             | Mechanics 3.....  | 15    | .....                  | 3                      | 53              | 103    | 101                  |
| Quantitative Analysis.....         | Chemistry 2.....  | 15    | 1                      | 6                      | 61              | 401    | 400                  |
| Exploration and Shaft Sinking..... | Mining 1.....     | 15    | 2                      | .....                  | 74              | 450    | Entrance             |
| Non-Ferrous Metallurgy.....        | Metallurgy 2..... | 15    | 3                      | .....                  | 70              | 426    | 425]                 |
| Structural Geology.....            | Geology 3.....    | 15    | 2                      | 1                      | 64              | 405    | 406                  |
| Assaying.....                      | Chemistry 3.....  | 15    | .....                  | 6                      | 68              | 420    | 400                  |
| Military Science.....              | Mil. Science..... | 15    | 2                      | .....                  | 83              | 501    | 500                  |
| Technical Writing.....             | English 1.....    | 15    | 2                      | .....                  | 61              | 600    | Third Year Entrance  |

| MINING ENGINEERING. |                                      |                     |        | FIRST SEMESTER          |                        |
|---------------------|--------------------------------------|---------------------|--------|-------------------------|------------------------|
| FOURTH YEAR         | SUBJECTS                             | Reference No.       | Weeks  | Hours per Week          |                        |
|                     |                                      |                     |        | Lectures and Class Room | Field Lab. or Drafting |
|                     |                                      |                     |        | For details see         |                        |
|                     |                                      |                     |        | Page                    | Course                 |
|                     | Summer School in Mining              |                     | 4 to 6 | 82                      | 466                    |
|                     | Hydraulics 1.....                    | Hydraulics 1.....   | 15     | 54                      | 111                    |
|                     | Hydraulics Laboratory.....           | Hydraulics 2.....   | 15     | 54                      | 112                    |
|                     | Electric Machinery.....              | Elec. Eng. 1-A..... | 15     | 30                      | 201A                   |
|                     | Elec. Eng. Laboratory.....           | Elec. Eng. 2.....   | 15     | 34                      | 250A                   |
|                     | Mill Construction.....               | Mining 3.....       | 6      | 80                      | 460                    |
|                     | Mine Plant Design.....               | Mining 4.....       | 15     | 81                      | 461                    |
|                     | Economic Geology.....                | Geology 4.....      | 15     | 65                      | 407                    |
|                     | Metallurgy of Iron and Steel.....    | Metallurgy 3.....   | 15     | 71                      | 427                    |
|                     | Metallurgy Laboratory.....           | Metallurgy 4.....   | 15     | 63                      | 403                    |
|                     | Ore Dressing.....                    | Metallurgy 5.....   | 15     | 79                      | 453                    |
|                     |                                      |                     |        |                         | Third Year Work.       |
|                     |                                      |                     |        |                         | 101-102                |
|                     |                                      |                     |        |                         | 101-102-111            |
|                     |                                      |                     |        |                         | Entrance.              |
|                     |                                      |                     |        |                         | Entrance.              |
|                     |                                      |                     |        |                         | 101, 102, 105          |
|                     |                                      |                     |        |                         | With 460               |
|                     |                                      |                     |        |                         | 405, 406               |
|                     |                                      |                     |        |                         | 400, 401, 425          |
|                     |                                      |                     |        |                         | 420                    |
|                     |                                      |                     |        |                         | Entrance               |
| SECOND SEMESTER     |                                      |                     |        |                         |                        |
| FOURTH YEAR         | SUBJECTS                             | Reference No.       | Weeks  | Hours per Week          |                        |
|                     |                                      |                     |        | Lectures and Class Room | Field Lab. or Drafting |
|                     |                                      |                     |        | For details see         |                        |
|                     |                                      |                     |        | Page                    | Course                 |
|                     | Excavation.....                      | Mining 2.....       | 15     | 75                      | 454                    |
|                     | Exploitation Haulage & Pumping.....  | Mining 5.....       | 15     | 76                      | 451                    |
|                     | Ventilation Valuation Account'g..... | Mining 6.....       | 15     | 77                      | 452                    |
|                     | Economic Geology.....                | Geology 5.....      | 15     | 66                      | 408                    |
|                     | Contracts & Specifications.....      | Contracts 1.....    | 15     | 36                      | 270                    |
|                     | Mine Plant Design.....               | Mining 4.....       | 15     | 81                      | 461                    |
|                     | Metallurgical Laboratory.....        | Metallurgy 6.....   | 15     | 63                      | 404                    |
|                     | Thesis.....                          | Mining 8.....       | 15     | 81                      | 465                    |
|                     |                                      |                     |        |                         | All Preceding Work     |

## FIRST SEMESTER

## MINING ENGINEERING.

(Coal Mining Option.)

THIRD YEAR  
Engineering Camp.  
Three weeks field practice.

| SUBJECTS                            |  | Reference No. | Weeks | Hours per Week          |                        |      | For details see |                     | Pre-Requisites, Etc. |
|-------------------------------------|--|---------------|-------|-------------------------|------------------------|------|-----------------|---------------------|----------------------|
|                                     |  |               |       | Lectures and Class Room | Field Lab. or Drafting | Page | Course          |                     |                      |
| Mechanics of Engineering I.....     |  |               |       | 5                       | .....                  | 52   | 101             | Third Year Entrance |                      |
| Steam Eng., Turbines & Boilers..... |  |               |       | 3                       | .....                  | 41   | 301A            | Third Year Entrance |                      |
| Applied Geology.....                |  |               |       | 2                       | .....                  | 64   | 405             | Third Year Entrance |                      |
| Principles of Metallurgy.....       |  |               |       | 3                       | .....                  | 69   | 425             | Third Year Entrance |                      |
| Mechanical Eng. Laboratory.....     |  |               |       | .....                   | 3                      | 45   | 350             | Third Year Entrance |                      |
| Electrical Machinery.....           |  |               |       | 2                       | .....                  | 31   | 201A            | Third Year Entrance |                      |
| Electrical Laboratory.....          |  |               |       | .....                   | 3                      | 34   | 250             | Third Year Entrance |                      |
| Exploration & Shaft Sinking.....    |  |               |       | 5                       | .....                  | 74   | 450             | Third Year Entrance |                      |
| Advanced Surveying.....             |  |               |       | .....                   | 9                      | 55   | 120             | Third Year Entrance |                      |
| Military Science.....               |  |               |       | 1                       | .....                  | 83   | 500             | Third Year Entrance |                      |
| Physical Training.....              |  |               |       | .....                   | 1                      | 85   | 510             | Third Year Entrance |                      |

## THIRD YEAR

## SECOND SEMESTER

| SUBJECTS                    | Reference No.  | Weeks  | Hours per Week          |                       |      | For details see |                      | Pre-Requisites, Etc. |
|-----------------------------|----------------|--------|-------------------------|-----------------------|------|-----------------|----------------------|----------------------|
|                             |                |        | Lectures and Class Room | Field Lab or Drafting | Page | Course          |                      |                      |
| Mechanics of Engineering II | Mechanics 2    | 15     | 5                       | .....                 | 53   | 102             | 101                  |                      |
| Structures I                | Civil Eng. 3   | Last 6 | 5                       | .....                 | 53   | 105             | 102                  |                      |
| Steam Machinery             | Thermo. 2      | 15     | 3                       | .....                 | 42   | 302             | 301                  |                      |
| Mech. Eng. Laboratory       | Mech. Eng. 4   | 15     | .....                   | 3                     | 45   | 351             | 302                  |                      |
| Excavation                  | Mining 2       | Last 9 | 5                       | .....                 | 75   | 454             | 450                  |                      |
| Non-Ferrous Metallurgy      | Metallurgy 2   | 15     | 3                       | .....                 | 70   | 426             | 425                  |                      |
| Quantitative Analysis       | Chemistry 2A   | 15     | 1                       | 3                     | 63   | 402             | Special Short Course |                      |
| Electrical Machinery        | Elec. Eng. 4A  | 15     | 2                       | .....                 | 31   | 202A            | 201                  |                      |
| Electrical Eng. Laboratory  | Elec. Eng. 5   | 15     | .....                   | 3                     | 34   | 251             | 201                  |                      |
| Mineralogy                  | Geology 2A     | 15     | .....                   | 3                     | 65   | 406             | 405                  |                      |
| Mine Surveying              | Mining 7       | 15     | 3                       | .....                 | 67   | 415             | Engineering Camp.    |                      |
| Military Science            | Mil. Science 2 | 15     | 2                       | .....                 | 83   | 501             | 500                  |                      |
| Technical Writing           | English        | 15     | 2                       | .....                 | 61   | 600             | Third Year Entrance  |                      |

FOURTH YEAR  
Summer Mining School.  
Four to Six weeks.

MINING ENGINEERING.  
(Coal Mining Option.)

FIRST SEMESTER

| SUBJECTS                          | Reference No. | Weeks | Hours per Week          |                        | For details see |        | Pre-Requisites, Etc.  |
|-----------------------------------|---------------|-------|-------------------------|------------------------|-----------------|--------|-----------------------|
|                                   |               |       | Lectures and Class Room | Field Lab. or Drafting | Page            | Course |                       |
| Mill Construction.....            | Min. Eng. 3   | 6-0   | 5                       | .....                  | 80              | 460    | 101, 102, 105         |
| Mine Plant Design.....            | Min. Eng. 4   | 15    | .....                   | 6                      | 81              | 461    | With 460              |
| Metallurgy of Iron and Steel..... | Metallurgy 3  | 15    | 3                       | .....                  | 71              | 427    | 402                   |
| Metallurgical Laboratory.....     | Metallurgy 4A | 15    | .....                   | 3                      | 63              | 403A   | Short Crs. on Coals.  |
| Steam Power Plants.....           | Mech. Eng. 8  | 15    | 3                       | .....                  | 43              | 303    | 301, 302              |
| Testing Materials.....            | Mechanics 3   | 15    | .....                   | 3                      | 53              | 103    | 101, 102, 105         |
| Ore Dressing.....                 | Metallurgy 5  | 15    | 3                       | .....                  | 79              | 453    | Entrance Requirements |
| Economic Geology.....             | Geology 4     | 15    | 2                       | .....                  | 65              | 407    | 405, 406.             |
| Theoretical Hydraulics.....       | Hydraulics 1  | 9-0   | 3                       | .....                  | 54              | 111    | 111                   |
| Hydraulic Laboratory.....         | Hydraulics 2  | 9-0   | .....                   | 2                      | 54              | 112    | 1101                  |

FOURTH YEAR

SECOND SEMESTER

| SUBJECTS                          | Reference No.  | Weeks | Hours per Week          |                        | For details see |        | Pre-Requisites, Etc.         |
|-----------------------------------|----------------|-------|-------------------------|------------------------|-----------------|--------|------------------------------|
|                                   |                |       | Lectures and Class Room | Field Lab. or Drafting | Page            | Course |                              |
| Ventilation Valuation Account'g.  | Min. Eng. 6    | 15    | 3                       | .....                  | 77              | 452    | .....                        |
| Mine Plant Desirn.....            | Min. Eng. 4    | 15    | .....                   | 6                      | 81              | 461    | 460                          |
| Exploration, Haulage, Pumping.    | Min. Eng. 5    | 15    | 3                       | .....                  | 76              | 451    | .....                        |
| Metallurgical Laboratory.....     | Metallurgy 6A  | 15    | .....                   | 6                      | 63              | 404    | 403A, short course on Coals. |
| Steam Turbines.....               | Mech. Eng..... | 15    | 2                       | .....                  | 44              | 305    | 301, 302                     |
| Gas Engines.....                  | Mech. Eng..... | 15    | 3                       | .....                  | 45              | 306    | 301, 302                     |
| Electric Distribution.....        | Elec. Eng..... | 15    | 3                       | .....                  | 32              | 209    | 201, 202                     |
| Thesis.....                       | Min. Eng. 8    | 15    | .....                   | 6                      | 81              | 465    | All Preceding work.          |
| Contracts and Specifications..... | Contracts..... | 15    | 1                       | .....                  | 36              | 270    | .....                        |

GRADUATES OF THE NOVA SCOTIA TECHNICAL COLLEGE.  
1910.

| Name.                 | Home Address             | Where Previously Educated |
|-----------------------|--------------------------|---------------------------|
| F. R. Archibald.....  | Halifax, N. S.....       | Dalhousie University.     |
| F. M. Dawson.....     | Truro, N. S.....         | Dalhousie University.     |
| C. L. Dimock.....     | Upper Newport, N. S..... | Dalhousie University.     |
| T. W. Hardy, Jr.....  | Halifax, N. S.....       | Dalhousie University.     |
| E. S. Kent.....       | Truro, N. S.....         | Dalhousie University.     |
| A. G. McAulay.....    | Glace Bay, N. S.....     | Dalhousie University.     |
| *N. W. McKay.....     | Balmoral Mills.....      | Dalhousie University.     |
| Walter Putnam.....    | Maitland, N. S.....      | Dalhousie University.     |
| E. L. Thorne, Jr..... | Dartmouth, N. S.....     | Dalhousie University.     |

1911.

| Name.                  | Home Address              | Where Previously Educated |
|------------------------|---------------------------|---------------------------|
| H. F. Bober.....       | Windsor, N. S.....        | King's College.           |
| *J. L. Cavanagh.....   | New Glasgow, N. S.....    | Dalhousie University.     |
| K. G. Chisholm.....    | Halifax, N. S.....        | Dalhousie College         |
| D. M. Collingwood..... | Upper Parkstone, Eng....  | Dalhousie University.     |
| T. M. DeBlois.....     | Halifax, N. S.....        | Dalhousie University.     |
| C. K. Hood.....        | Yarmouth, N. S.....       | Mt. Allison University.   |
| J. F. Lumsden.....     | Gabarus, C. B.....        | Mt. Allison University.   |
| R. W. McColough.....   | Waverly, N. S.....        | Dalhousie University.     |
| C. H. MacDonald.....   | Sydney, C. B.....         | Dalhousie University.     |
| J. A. McKay.....       | Balmoral Mills, N. S..... | Dalhousie University.     |
| L. A. Mylius.....      | Halifax, N. S.....        | Dalhousie University.     |
| Gordon S. Stairs.....  | Halifax, N. S.....        | Dalhousie University.     |

1912.

| Name.                | Home Address            | Where Previously Educated |
|----------------------|-------------------------|---------------------------|
| G. V. Boone.....     | St. Johns, Nfld.....    | Mt. Allison University    |
| D. R. McKean.....    | West La Have, N. S..... | Dalhousie University.     |
| C. E. McKenzie.....  | Springhill, N. S.....   | Dalhousie University.     |
| Ranold McKinnon..... | New Aberdeen, N. S..... | Dalhousie University.     |
| J. W. Morrison.....  | Oldham, N. S.....       | Dalhousie University.     |
| C. B. North.....     | Hantsport, N. S.....    | Mt. Allison University.   |
| G. F. Simson.....    | Halifax, N. S.....      | Dalhousie University.     |

\*Not granted full Diploma.

## GRADUATES OF THE NOVA SCOTIA TECHNICAL COLLEGE

1913.

| Name.                | Home Address              | Where Previously Educated |
|----------------------|---------------------------|---------------------------|
| R. B. Carson.....    | Dartmouth, N. S.....      | Dalhousie University.     |
| O. S. Cox.....       | Upper Stewiacke, N. S.... | Dalhousie University      |
| C. S. Creighton..... | Dartmouth, N. S.....      | Dalhousie University.     |
| H. W. L. Doane.....  | Halifax, N. S.....        | Dalhousie University.     |
| J. D. Irving.....    | New Glasgow, N. S.....    | Dalhousie University.     |
| L. B. McCurdy.....   | Truro, N. S.....          | Dalhousie University.     |
| H. S. McKean.....    | North Sydney, N. S.....   | Mt. Allison University.   |
| I. P. McNab.....     | Upper Malagash, N. S....  | Mt. Allison University.   |
| W. H. Noonan.....    | Pictou, N. S.....         | Dalhousie University.     |
| J. P. Norrie.....    | Truro, N. S.....          | Mt. Allison University    |
| M. H. O'Brien.....   | Springhill, N. S.....     | Acadia University         |
| F. H. Palmer.....    | Halifax, N. S.....        | Dalhousie University.     |

1914.

| Name.                   | Home Address               | Where Previously Educated                            |
|-------------------------|----------------------------|------------------------------------------------------|
| E. W. G. Chapman.....   | Halifax, N. S.....         | Dalhousie University.                                |
| R. P. Donkin.....       | Halifax, N. S.....         | Acadia University.                                   |
| C. A. DeWitt Fowler.... | Halifax, N. S.....         | Mt. Allison University.                              |
| S. W. Gray.....         | Westville, N. S.....       | Dalhousie University.                                |
| H. W. Mahon.....        | Great Village, N. S.....   | Dalhousie University.                                |
| J. P. Messervey.....    | Halifax, N. S.....         | Dalhousie University.                                |
| D. R. Munro.....        | Amherst, N. S.....         | Mt. Allison University.                              |
| R. R. Murray.....       | Springhill, N. S.....      | Acadia University..                                  |
| T. J. MacKavanagh.....  | Shawinigan Falls, P. Q.... | Glasgow & West of<br>Scotland Technical Col<br>lege. |
| R. B. Roach.....        | Windsor, N. S.....         | King's College.                                      |
| K. E. Whitman.....      | Petite Riviere, N. S.....  | Mt. Allison University.                              |

## SHORT COURSE IN LAND SURVEYING.

1911.

| Name.                 | Home Address               |
|-----------------------|----------------------------|
| W. L. Brine.....      | French Village, N. S.      |
| C. F. Clark.....      | Halifax, N. S.             |
| H. J. Ewan.....       | Yarmouth, N. S.            |
| *W. H. Hooke.....     | Halifax, N. S.             |
| *R. A. Logan.....     | Middle Musquodoboit, N. S. |
| *R. J. Macdonald..... | Halifax, N. S.             |
| *R. J. Milgate.....   | Middleton, N. S.           |
| *P. G. Morrow.....    | Halifax, N. S.             |

1912.

| Name.                      | Home Address          |
|----------------------------|-----------------------|
| C. Avard White.....        | Woodstock, N. B.      |
| *Lindsay K. Patterson..... | Aylesford, N. S.      |
| *Chas. F. Whitman.....     | Halifax, N. S.        |
| A. C. Webster.....         | Canning, N. S.        |
| *A. M. Foster.....         | Bridgetown, N. S.     |
| C. Hagan.....              | Church Street, N. S.  |
| *Raymond Chisholm.....     | Harbour Bouche, N. S. |
| V. N. Elderkin.....        | Port Greville, N. S.  |
| *Daniel A. Gasper.....     | Truro, N. S.          |
| *J. O. Hunton.....         | Sackville, N. B.      |

1913.

| Name.                       | Home Address          |
|-----------------------------|-----------------------|
| William L. Brine.....       | French Village, N. S. |
| Vincent R. E. Harrison..... | Southampton, N. S.    |
| Freeman Tupper.....         | Milton, N. S.         |
| Harry E. McDonald.....      | D'Escouse, C. B.      |

SHORT COURSE IN LAND SURVEYING.—(*Continued.*)

1914.

| Name.                  | Home Address        |
|------------------------|---------------------|
| G. W. G. Allen.....    | Halifax, N. S.      |
| Peter Baxendale.....   | Sydney Mines, N. S. |
| Thomas H. Benthon..... | Sydney Mines, N. S. |
| Frank P. Brennan.....  | Halifax, N. S.      |
| James A. Donovan.....  | Halifax, N. S.      |
| Reginald Dickie.....   | Brookfield, N. S.   |
| Edwin Dorey.....       | Dartmouth, N. S.    |
| Bertram Padmore.....   | England             |
| G. A. Robertson.....   | Barrington Passage  |
| F. H. Zwicker.....     | Lunenburg, N. S.    |

## UNDERGRADUATES OF THE NOVA SCOTIA TECHNICAL COLLEGE

1914

## REGULAR STUDENTS.

| Name                 | Home Address.            | Where Previously Edncated        |
|----------------------|--------------------------|----------------------------------|
| L. N. Seaman.....    | Halifax, N. S.....       | Acadia University                |
| W. E. Jefferson..... | Lawrencetown, N. S.....  | King's College                   |
| W. P. Crowe.....     | Wolfville, N. S.....     | Dalhousie University.            |
| C. P. Blakeley.....  | Halifax, N. S.....       | Dalhousie University.            |
| J. W. Spence.....    | St. Croix, N. S.....     | King's College.                  |
| J. H. Dexter.....    | Brooklyn, N. S.....      | Acadia University                |
| E. Reinhardt.....    | La Have, N. S.....       | Acadia College                   |
| M. W. Kirwan.....    | Wallace, N. S.....       | St. Francis Xavier Col-<br>lege. |
| T. O. Murray.....    | Richbucto, N. B.....     | St. Francis Xavier Col-<br>lege. |
| J. A. McLeod.....    | Armstrong, Iowa, U.S.A.. | Dalhousie University.            |
| H. F. Paul.....      | Springhill, N. S.....    | Acadia University                |
| R. P. Freeman.....   | Halifax, N. S.....       | Dalhousie University.            |
| O. E. Prestwood..... | Southampton, N. S.....   | Acadia University.               |
| R. M. Kinnie.....    | Berwick, N. S.....       | Acadia College                   |
| J. W. McDonald.....  | Green Hill, N. S.....    | Dalhousie College.               |
| A. W. James.....     | London, Ontario.....     | Dalhousie University.            |

## SPECIAL STUDENTS.

| Name                         | Home Address.       |
|------------------------------|---------------------|
| H. W. L. Doane.....          | Halifax, N. S.      |
| L. B. McCurdy.....           | Halifax, N. S.      |
| Arnel Roderick Millburn..... | Sydney Mines, N. S. |
| Thomas Martin.....           | Halifax, N. S.      |
| H. R. Harrison.....          | Halifax, N. S.      |
| T. J. Harrison.....          | Dartmouth, N. S.    |
| J. H. McDonald.....          | Halifax, N. S.      |
| Frank E. Hiseler.....        | Halifax, N. S.      |
| E. Dobson.....               | Halifax, N. S.      |
| Frank Reardon.....           | Halifax, N. S.      |
| Gordon Duncan.....           | Halifax, N. S.      |







